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Battelle Technical Review

IN THIS ISSUE: The Metallurgical Challenge of Missilery

VIGNETTE

DONALD J. BOWERS

Imaginativeness and knowledgeability, of course, play a real part in the effectiveness of a research project and the speed with which it is brought to a successful conclusion. It is in research planning, believes Donald J. Bowers, that the intuition of the technologist is likely to be especially effective. The imaginative technologist who in his planning is able to call upon a solid background of prior study and experience, Don adds, frequently can intuitively start a research program quickly along a rewarding path. The advantages to be gained are obvious—less time lost getting to the heart of the problem and more rapid completion of a meaningful study.

Don's field of activity is ceramic technology. A major interest has been a continuing study of friction materials for braking systems, and he has been instrumental in the development of several such materials. Among other research programs to which he has contributed since his association with Battelle have been those concerned with quarry tile, lightweight aggregates, flyash, slag, mortars, silica refractories, materials for rocket and jet engines, and carbon and graphite for electrodes. In the area of oxide technology, Don has studied both sintered and hot-pressed magnesia, the latter having considerable promise for lenses for infrared transmission.

Undertaking difficult problems holds a special delight for Don. His colleagues find him a fertile source of help in such tasks as planning research programs, resolving difficult experimental problems, and suggesting designs for experimental equipment. While he finds any unsolved technical problem a challenge, Don readily confesses to enjoying research that has foreseeable applications.

After receiving his bachelor's degree in ceramic enginering in 1944, Don later continued study at Ohio State University for his M.S. in the same field. Thereafter, he was associated with Ferro Corporation in the design and construction of continuous commercial kilns before joining Battelle in 1951. Along with other professional activities, Don participates in the work of the American Ceramic Society.

Four sons, aged two to nine, provide a busy home life for both Don and his wife, Jane. Fortunately Don likes to work at many tasks around home. Understandably, the entire family enjoys the week-end automobile tours and occasional evening picnics which he and Jane plan.

BATTELLE TECHNICAL REVIEW

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Is Information a Problem to Scientists?

Extensive concern over the flood of published scientific information is growing daily. A congressional committee has looked into the matter. Symposiums are convened to discuss the situation. Universities hold seminars and present courses on the subject. Research studies are under way on many facets of the problem—linguistics and semantics, translating, abstracting, information manipulating, storing, retrieving, and disseminating. Significantly, however, very little research concerns the relationship between scientists and the information available.

The apparently almost unanimous belief that something must be done about the growing volume of information implies several conclusions that some would question: (1) our scientists are now relatively poorly informed; (2) they would progress faster if they could read either more, or more selectively, both the U. S. and foreign literature; and (3) U. S. scientists are doing appreciable research that duplicates work already done. Can these implications be substantiated?

The question should be asked: Is the great mass of scientific and technical literature being produced a real problem? If so, to whom? It is no longer enough to quote frightening statistics of the numbers of articles, journals, and books being produced. There is good evidence that our scientists—using the present "unorganized" independent, but effective information net—are missing little of vital importance. They have their own effective methods and sources. Ask any scientist "Who are the 10 or 15 most important scientists in your field?" or "What research organizations are making the best advances in your field?" He will be able to give you the answers quickly and accurately. Moreover, those who need the information will be able to name the top men in their fields in other countries, as well. Thus, they know where to look for the information they need.

It has been estimated that tens of millions of dollars are being spent in research to improve our information capabilities. Before these perhaps unneeded expenditures are further swollen, let us study the question from a scientific viewpoint. We need scientific evidence on such matters as the items of scientific information that have been missed by technologists and the scientific value of such misses. We also need to know more about how scientists use the information they obtain from various sources.

We may find that the flood of scientific information is really injuring no one—that the fussing is largely a reaction to the Sputniks and Luniks.

G. S. Simpson, Jr.,
project consultant,
Battelle Memorial Institute.

The Metallurgical Challenge of Missilery

The missile industry uses a small tonnage of metals, but requires the utmost in metal properties, thus serving as a goad to metallurgical research. The author reviews the demands which space vehicles place upon metals and suggests how the needs may be met.

by W. Stuart Lyman

The demands of missilery have a highly significant role in today's technology. Missile development is calling for the best efforts of scientists and engineers in almost every field. Prominent among those contributing heavily to these new vehicles are the metallurgists.

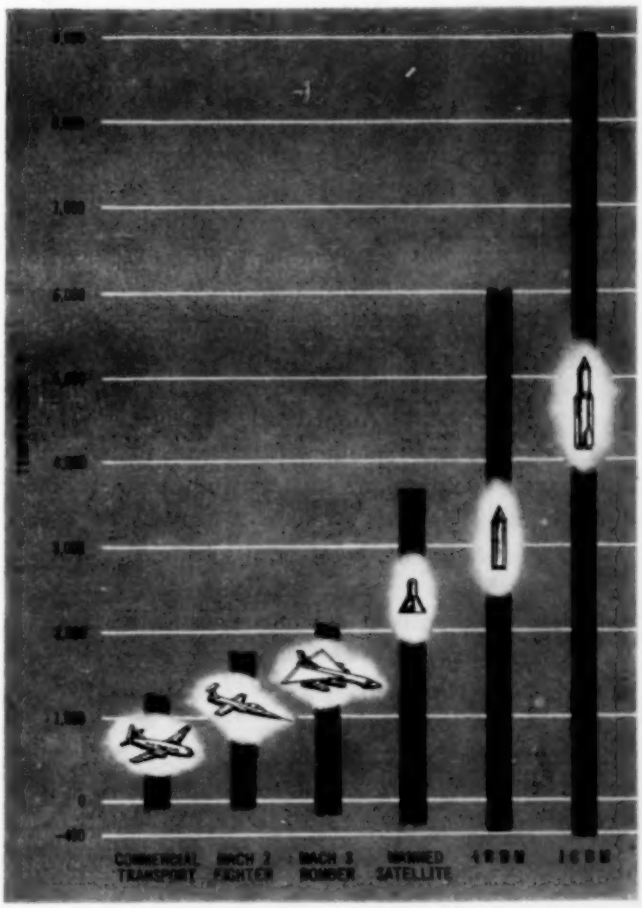
The application of metals in missiles is but a small detail in the total metalworking picture. Paradoxically, missile applications are probably the greatest single current stimulant to metals research and development. In 1959, metal consumption by the U. S. metalworking industry totaled over 100 millions tons. In comparison, the total annual metal requirement of the aircraft and missile industries, decreasing every year for the past six, can be estimated to be about 95,000 tons. Missile applications are but a small part of even this unimpressive total.

Why is this tiny fraction of the country's metal consumption responsible for more metallurgical research perhaps than any other single market? The primary reason, of course, is that national security depends directly on missile developments and missile developments demand improved alloys and new metal fabrication techniques.

One unique aspect of missile metallurgy is the intrusion of chemical engineering considerations into the metal engineer's field of awareness. Chemical engineers and metallurgists collaborate most closely on fuel developments and on problems of corrosion and pyrophoricity. Rate processes, long a concern of chemical engineers, now concern metallurgists. Ablation, corrosion, oxidation, and short-time creep and fatigue are real, time-dependent problems to missile application metallurgists. Refining and producing some of the newly useful metals—beryllium, columbium, molybdenum, titanium—are also essentially chemical engineering operations.

Operating Environment for Missile Structures

Environment, for this discussion, is the composite of the individual and combined external influences acting on the missile structure which tend to complicate its design. The main elements of environment, so defined are: (1) temperature, (2) loads, (3) configuration, (4) time (service life), and (5) chemical media.



1. *The approximate maximum and minimum temperature ranges to which the metal parts of various types of air vehicles are subjected.*

Temperature

Missile temperature environments are unique for structural materials. Temperature can range, in a single (hypothetical) missile, from roughly —400 F to a calculated equilibrium skin temperature of as high as 9000 F. The figure is a hypothetical temperature corresponding to the heat flux associated with a particularly desired trajectory or mission. No present materials can withstand 9000 F, so this heat flux must be dissipated by ablation, conduction, or cooling media and consequently the measurable temperature will be lower. Typical aircraft and missile temperature environments, both real and hypothetical, are compared in Figure 1; the figure includes both airframe and engine parts.

The broad temperature range experienced in missiles leads to a wide spectrum of problems that arise from the effects of tempearture variation on metallic properties. Strength goes down and ductility rises as temperature increases. There are three distinct slices of this problem spectrum that concern the missile metallurgists and structures engineers: they must seek (1) toughness at very low temperatures; (2) strength at intermediate temperatures; and (3) resistance to extremely high temperature.

The low temperatures referred to originate in the liquefied gases used as fuels, auxiliary power sources, or as pressure sources. The development of helium storage bottles for the Atlas missile is a nice demonstration of a low-temperature materials application. It represents a problem solved through alloy selection, fabrication development, and improved design. The problem was to construct the lightest bottle that would withstand the specified (low) temperature and stress conditions, at a reasonable price. The eventual solution was a welded, heat-treated bottle of Ti-6Al-4V alloy. In this case, recent metallurgical research contributed not only the welding and heat-treating techniques but the titanium alloy itself.

At the top of the temperature spectrum, the problem is to resist the brief assaults of heat that occur at the two ends of the missile; exhaust gases at the rear and aerodynamic heating at the front.

The "intermediate" temperature range in missiles is from a little below zero to about 1500 F. Probably the primary structure of all missiles now flying or in development are in this range. The problem here is strength at temperature, or more exactly, density/strength ratio at temperature—for missile structures are designed to minimize weight.

To summarize, in the intermediate temperature range, commercial alloys vie for selection: aluminum, magnesium, nickel-base alloys, steels, and titanium. At cryogenic temperatures, solutions come largely from improved component design and thoughtful alloy selection. At the high-temperature end of the scale the problem is mainly metallurgical, for new alloys and coatings are required. These alloys when developed, will be produced on a "microscale" (compared to the tonnage metal industries) for specific applications and will comprise only a small per cent of the very small metal requirement for missiles.

Loads and Configuration

Loads on missile structures are unique because of their time variation and because they occur in unprecedented configurations. Time is compressed in missilery. Commercial and even military aircraft are designed to last many thousands of hours. Missiles fly but once, and at speeds and accelerations that make loads fluctuate and change rapidly. A typical missile control fin, for example, might undergo two tensile and three compressive maximums in less than two seconds.

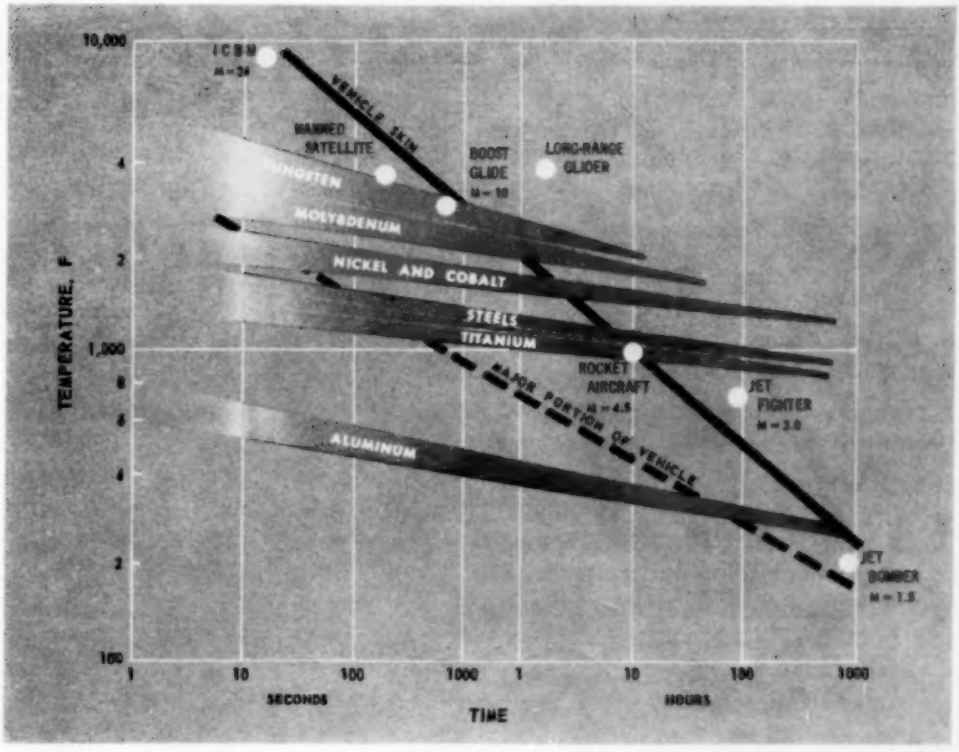
Rapid loading and heating of missiles has resulted in a new field of materials testing—the measurement of properties under rapid heating and loading conditions. Actual utilization of such test results in design has not advanced far, however, to judge from the literature.

Conventional aircraft structures are mostly critical in compression. In missiles, critical loads are more likely to be tensile because missile configurations are essentially thin shells loaded biaxially by internal pressure—often to within 10 to 15 per cent of their yield strength.

Long-range missiles all seem to look alike. Actually,

A paper presented by Stuart Lyman before a symposium on "Missile Structure Materials" at the recent National Meeting of the American Institute of Chemical Engineers in St. Paul is largely the basis for this article. The paper is an outgrowth of his work in directing informational activities for the former Titanium Metallurgical Laboratory and of materials applications studies he conducted for the Defense Metals Information Center. Currently the author is involved in research on metals production and fabrication problems. Prior to joining Battelle, Lyman was associated with the National Academy of Sciences, where he had responsibilities in connection with the operations of committees of the Metals Advisory Board.

details of configuration, loading, and structure can be sharply different despite apparent similarity. Different design approaches, for example, may make the difference between compressive and tensile loading. Thus the Convair Atlas and the Martin Titan missiles have roughly the same mission, size, and shape; yet the structures differ markedly. Three-fourths of the length of the Atlas is simply a lightweight, thin - walled steel tank, without internal structure. The tank is so thin it cannot support its own weight; internal pressure is needed to maintain its shape. Thus, the net stress in a large part of the Atlas structure is always tensile. The Titan missile, on the other hand, is constructed primarily of aluminum and magnesium alloys. According to articles in the engineering and trade journals, the structure is a conventionally stiffened skin; the loading must be primarily compressive.



2. *Shown here are maximum use temperatures of several classes of alloys for long- and short-time service in relation to the apparent temperature requirements of future air vehicles. Maximum temperature and service life for several hypothetical vehicles appear as data points. Based on these points, the solid line indicates the trend of maximum skin temperature with service life. The broken line indicates the same trend for the balance of the vehicle's structure. The pennant-like bars suggest maximum use temperature ranges for several families of alloys as related to exposure time.*

Solid-propellant-fueled rockets present a third type of structure. The net loading on the motor case, which is a large part of the structure, is tensile during burning. As flight continues after burnout, compression loads may dominate.

Handling loads can also be the main consideration, especially in small missiles. Structures strong enough to resist flight loads may be too flimsy to resist ground handling.

Service Life and Chemical Media

Time is an important element of missile material environment. Service life is short, orders of magnitude shorter than has been usual for air vehicles. Shelf life may be long, however.

Figure 2 shows the time-maximum temperature environment for the airframe portion of various air weapon systems based on a figure by W. H. Steurer and data from Wright Air Development Center sources. The jet bomber is five cycles removed on the logarithmic time scale from the ICBM and nearly two cycles on the temperature scale—truly orders of magnitude different. The skin temperatures shown (solid line) are calculated maximum skin temperatures. The entire structure is not at the tempearture shown. Far from it. Actual data on this point for specific missiles are hard to find in the literature. A study of a hypothetical long-range ballistic missile included calculations of skin-temperature variation with distance aft from the stagnation point. F. M. Anthony and H. A. Pearl have discussed structure-temperature variation inward from the boundary layer. Calculations by R. J. Masson and C. Gazeley, Jr., also provide some insight into how structure temperature varies with distance from the leading edge. Based on these generalized data the dotted line in Figure 2 has been drawn in an attempt to indicate what the maximum temperature for, say, 85 to 90 per cent of the structure might be. This emphasizes again the fact that the high-temperature materials problem in missiles (and aircraft), though extreme, is strictly limited, clearly comprehensible, and capable of solution through careful research study. No new metal industries are needed.

Oxidation is the main materials problem when temperatures rise above 2000 F. Chemical attack by pro-

pellants also may occur. Red fuming nitric acid and titanium can be a pyrophoric combination; structural metals can detonate in liquid oxygen; some alloys catalyze the breakdown of hydrogen peroxide; fluorine corrodes nearly everything. Exhaust gases, especially from metallized fuels, erode and corrode metal parts in their blast.

Alloy Selection for Missile Service

How are materials selected for missile structures which must endure these dire environments? Material selection became a major engineering function in airframe construction only about ten years ago. Selection for engines has been important a little longer. Until after World War II, a half dozen or fewer engineers usually could comprehend all the metallurgy involved in the material-selection, quality-control, and failure-examination activities of a large aircraft company.

Times have changed. Today it takes a legion of materials men to operate on a much smaller amount of material. Material selection has become complex. Some causes of this are:

1. More demanding performance (hotter structures, more rapid accelerations)
2. Multiplication of the available materials (each with its unique properties)
3. Increased knowledge of design criteria and their use
4. More complex fabrication choices
5. Increasing concern about cost.

All these items—environment, properties, design criteria, producibility, cost—are involved in material selection for missiles. Also involved, frequently, are local lack of data and prejudice.

No one has yet written the book on material selection for missiles, but some guidelines are available. Selection generally proceeds, stepwise, by a series of compromises from the ideal choice to the practical.

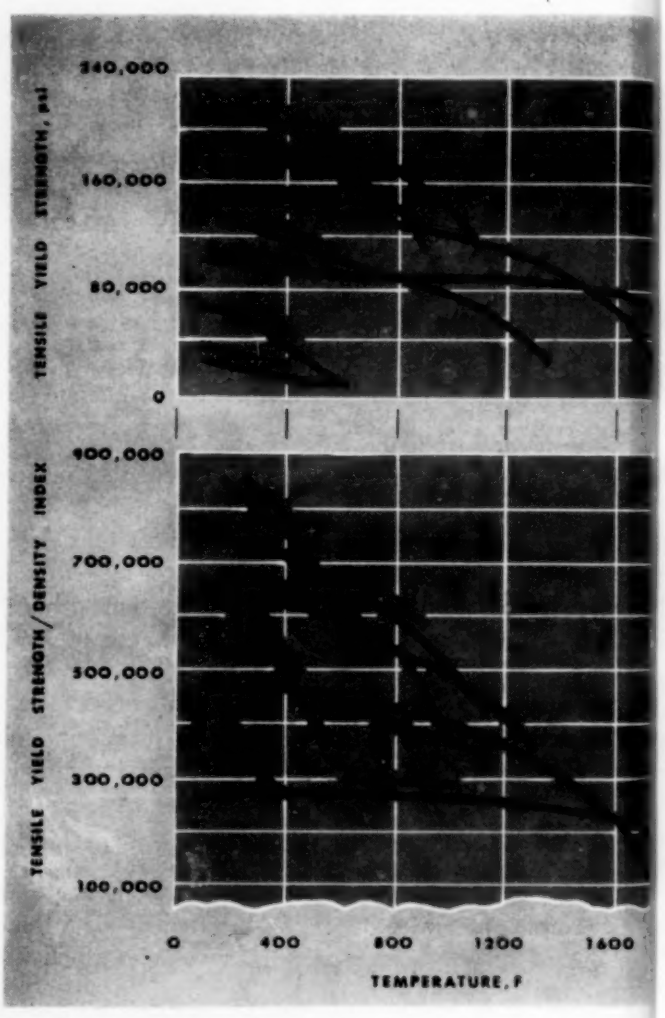
Strength Properties

Ideally, missiles (whose structures get hot) are designed to minimize weight, so the ratio of density/strength at temperature is the predominant index of merit for alloys for missiles. The index may simply relate density to yield strength or it may be an elaborate function based on some specific failure criterion.

In Figure 3 (upper section), the temperature variation of yield strength for several available classes of alloys is plotted. A considerable alteration in the apparent order of merit of these alloys occurs when the temperature variation of the density/strength ratio is plotted, as in the lower section of the figure. Also noteworthy is the fairly narrow spread between the density/strength index ranges for nickel-base alloys, stainless steel, titanium, and tool steels in the range 500 to 1200 F. The smaller the difference in density/strength ratio the more influential become the other selection factors — corrosion resistance, fabricability, cost. Minimum weight governs so long as fabrication is possible and the costs can be supported.

Resistance to Heat and Chemical Attack

The major portion of any missile structure is designed for strength, at operating temperature. A small but vital portion of each missile is designed more for heat resistance per se than for strength. This por-



3. *Plotting yield strength/temperature ranges (top) for some alloy types used in missiles shows how their strength properties are affected by temperature. Yield strength/density ratio plotted versus temperature (bottom) for the same alloys over the same temperature range shows how weight considerations alter the order of merit of the alloys in missile design. The specific alloys represented here are: H-11 (tool steel); 17-7 PH (PH stainless); Rene 41 (nickel base); Ti-6Al-4V (titanium); Mo-0.5Ti (molybdenum); 2024-T86 (aluminum); and HK31-T6 (magnesium).*

tion comprises the very hot parts of the missile: jet vanes, jetavators, rocket nozzles, leading edges, and re-entry surfaces and edges.

There have been several published estimates of maximum-use temperature of metals and alloys. Dr. C. H. Lorig, of Battelle; C. M. Brown and R. W. Fountain, of Union Carbide Metals; and P. Duwez, of California Institute of Technology have authored three of these. In addition, an increasing amount of rapid-loading, rapid-heating test data on refractory metals is becoming available. Based on these sources, an estimated maximum-use temperature for various service times appear in Figure 2. The estimated maximum-use-temperature ranges are superposed on the estimated curves for maximum skin-structure temperature. Most structures, it appears, can be built with available, non-refractory alloys. It is striking, again, how clearly defined and limited is the refractory-metal applications problem in missiles. No new tonnage industries seem to be required, only research results which can be used with low production batch-process methods.

There is one absolute minimum requirement for proper alloy selection for service in contact with missile propellants: specific test data on the compatibility of the chemical media involved and the potentially usable alloys.

A considerable body of data on the compatibility of propellants and metals is available to the missile maker and his subcontractors. Even so, many combinations and sets of conditions have not yet been evaluated and care should be the watchword.

Fabricability

The relative ease with which different alloys can be made into finished parts is always a factor, and sometimes the deciding factor, in alloy selection for missile application. Choice of fabrication method is usually closely related to design approach. There are an infinite number of possible paths from conception to finished part, and it is surely true that there is no one best fabrication method. It is usually difficult even to distinguish between just two completely different solutions to the problem of how to build a missile.

Consider again Atlas and Titan. The Atlas, as was mentioned, is a thin-walled, pressurized structure without internal framework. Fabrication is by welding; the material of construction is cold-rolled austenitic stainless steel strip. Up to 36-inch wide strips are butt-welded into sections and the sections welded together to form the main portion (the tankage) of the missile.

The Titan, is, for our discussion, completely similar in purpose to the Atlas. Its structure, however, appears to be the result of traveling a different path from concept to finished article. According to information in the technical and trade journals, the aluminum- and magnesium-alloy structure is essentially of the stiffened-skin or skin-stringer type. Apparently welding is the primary method of joining. Welding is nearly universal in solid-propellant powered missiles also.

Fabrication of the large domes, cones, and bulkheads required in missile structures is a challenge to the producibility engineer. The present alternatives seem to be: spinning, deep drawing, forging, and now, explosive forming.

When the design is a thin-walled pressure vessel, the availability of suitably thin, flat sheet may become a problem. Metal producers have a fabrication problem in rolling thin sheets, say under 0.020-inch thick, of some high-strength alloys to close tolerances. Thin-gage refractory metals are not yet available.

Cost Considerations

The last great summarizing factor in materials selection is cost. Not just raw-material cost, but cost of finished parts, installed in the missile.

The aim is not to build the cheapest possible missile. Rather, the aim is to build, at least cost, a structure equal to the capabilities of the other components of the system—power plant, guidance, controls, propellants, and re-entry body. This means, in general, that the structure must be designed to lightest weight, at a supportable cost. The problems are (1) to find the value of saving a pound of weight, and (2) to know how materials, fabrication, and installation costs vary from alloy to alloy. Finding the solution to these two problems is the essence of missile-materials engineering. Once this is done, the rest is arithmetic.

Conclusion

Metallurgists have solved, or are on the way to solving many of the problems raised in their field by missile development. Yet the metallurgist cannot meet all needs through improvements in alloys and fabrication techniques. In some cases it will be necessary to resist missile environments by design ingenuity or by improved mechanical, cooling, or insulating techniques.

In the future as now, the market for many of the alloys developed for missiles will continue to be small. But as alloys are developed, resourceful materials-application engineers will find economic uses for them in industrial fields as well, and the entire economy will benefit. Thus through the challenging demands of missilery, metallurgical science will be advanced. The full impact of this research on our general technology will not be felt for many years.

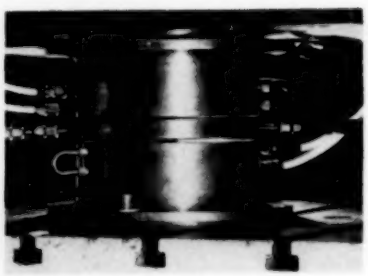
NEW LIGHT ON URANIUM OXIDES

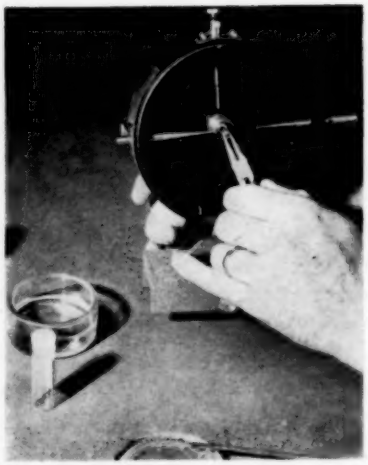
In research for the Atomic Energy Commission, scientists in Battelle's structural chemistry division have been investigating hitherto unexplored effects of pressures upon the uranium-oxygen system. Charles M. Schwartz, chief of the division states that the studies of the uranium-oxide system are required as a prerequisite for the evaluation of the effects of high pressure and temperature on the reactions of various oxides with uranium oxides.

Wendell B. Wilson, who guided much of the research, reports that one outcome of the investigation has been the discovery of a new uranium oxide, gamma U_3O_8. In general, he says, combined heat and pressure were found to effect the reduction of the higher (in oxygen) uranium oxides to structures having greater density.

Ultra-high-pressure equipment (top, right) was developed to provide the pressures and temperatures required for the study. Wilson is shown placing a specimen for processing (center, right) at pressures above one million psi and at temperatures in excess of 3600 F. (Pressures of the order of two million psi have been reached with the equipment.)

The processed oxides are then removed from their platinum capsule and placed in an X-ray camera for diffraction studies (bottom, right). The patterns of lines on the films (left) enable scientists to identify the structure of the material. The far left film shows the X-ray diffraction pattern of conventional alpha U_3O_8; the other reveals the presence of the new gamma U_3O_8.





Understanding Management's Role in Research

Utilizing research most effectively poses problems for the management of many companies. Three steps are suggested here for creating closer liaison between management and the research group and thus enhancing the company's research efforts.

by WILLIAM L. SWAGER

FEW IN MANAGEMENT will deny that the growth of research is a desirable and necessary development for our economy. But there are many executives who feel that research creates very serious problems for management.

Most companies are boosting their research expenditures annually by substantial amounts—many at a rate of 20 per cent or more per year. Will such expenditures assure success? According to J. V. N. Granger, President of Granger Associates, speaking of the electronics industry, "I'm confident that the industry can't and won't support everyone who is trying to get in. One of the most common problems is investing too much money in product development that does not pay off in the market place." Others, not limiting discussion to product development, point to the necessity of re-examining total research expenditures. And this general concern over research extends naturally to the over-all problem of administering company technical effort most effectively.

In terms of broad principles, the management of research is not greatly different from the management of any other major business function. The traditional general principles of management—plan, organize, and control—pertain. Management consists of formulating objectives and allocating resources to the achievement of these objectives. How to do this in the management of research, however, is not an agreed upon art. The literature on research management raises contradictory views on how, by whom, and for what purpose research should be managed.

BUSINESS AND TECHNICAL MANAGEMENT IN RESEARCH

The managing of the research function in the company involves two distinct, interrelated roles—business and technical. Each calls for the planning, organizing, and controlling of group effort. But each of these activities requires different kinds of talent. The responsibility in fulfilling the business role of research management is to organize so that research views are represented in major business decisions—to plan by identifying the company's needs, to control by measuring performance in relation to those broad needs, and to take appropriate action. In its technical role, management has several important responsibilities—organizing capable scientists and engineers for effective research, with freedom to work creatively; planning research projects that will instrument management's broad business objectives; and controlling the research activities by measuring progress in the light of criteria—technical and economic—derived from the broader goals of the company.

The fact that there are two distinct roles to be assumed in the management of research can lead to some confusion. In an article in the October, 1957 issue of FORTUNE entitled "Research Management: The New Executive Job", George A. W. Boehm stated, "Just how to train such an executive, nobody is quite sure. Some experts in management technique argue that a research director needs no scientific training. They contend that a good manager can soon pick up enough language in concepts of science to run any industrial laboratory. But the practice indicates that industry does not go along with that theory." Boehm has used the term "research director" and "research manager" interchangeably. Perhaps some definition and clarification could be achieved if the term "manager of research" were defined as the person having the ability to handle the business role of management noted above, and the director of research the ability to handle the technical role.

The requirements of either of these roles of management strains the capabilities of any one man. It is a rare man, indeed, who has the attributes and abilities to work effectively in both roles.

If these two roles in research management are recognized, the inconsistency is reconciled as between the experts in management technique and the industrial researchers to whom Boehm talked. If a technical director can handle well only the technical role in research management, there is a gap. Much of his laboratory's effort may be drained away on problems of questionable relevance to the business. If, on the other hand, a manager of research can handle well only the business role of research management, it is possible that he will stifle the creative efforts of his research people and reduce their output to run-of-the-mill mediocrity.

Much has been written about the job of technical director or research director. Most of that which has been written is about the managing of a research laboratory from the point of view of organizing, planning, and measuring the technical work. While it is recognized that improvements can be made in the technical role of research, the major problems are not to be found here, but in the business role of research management as defined above.

The "Gulf of Mutual Incomprehension"

"The trouble usually isn't in the lab, it's on top. As I see it, that's the most common weakness in general management today. You can walk into company after company—surely you have seen it yourself?—and find good financial management, good production management, good sales management—everything under tight control, until you hit research. Then, it's a wing and a prayer." So said Cash McCall in the popular book of that title by Cameron Hawley.

We must concur with Hawley's observation. In so doing, there is no attempt to lay the blame on any group of individuals—top management, managers of research, directors of research, or anyone else. In directing our attention to the "top", we are merely recognizing that there sometimes tends to be a major communications barrier between research and the rest of the company.

First, let us examine why this barrier sometimes exists. As previously pointed out, there has been limited recognition to date that research management has two distinct roles. When these roles are not carefully defined, it appears to the research workers that research decisions are being made by men who don't have the proper background and experience. Nothing is more deadly to the morale of a research organization. Most studies of the characteristics and attitudes of research scientists point up their reliance on the esteem and judgment of professional contemporaries. They intuitively challenge the wisdom of any one outside their field of specialization, and scientists are likely to resent technical decisions made by people outside the "brotherhood of science".

That research people are usually "things oriented" rather than "people oriented" is another cause for the problem. Even less tangible, but nevertheless important, is the fact that research, by its very nature, must challenge the *status quo*. Researchers must question present products and processes, challenge accepted theories, and generally "rock the boat". The natural resistance to change in the remainder of the organization can widen the gap.

C. P. Snow recently called a similar communications barrier "a gulf of mutual incomprehension"—a dramatic and vivid term, but perhaps, in this case, a shade too strong. While in some companies, the misunderstandings seem to warrant Snow's label, in others, they are relatively insignificant. Regardless, better understandings seem to warrent Snow's label, in others, management is essential. In spite of the seeming "incomprehension" there is more than just hope for improvement.

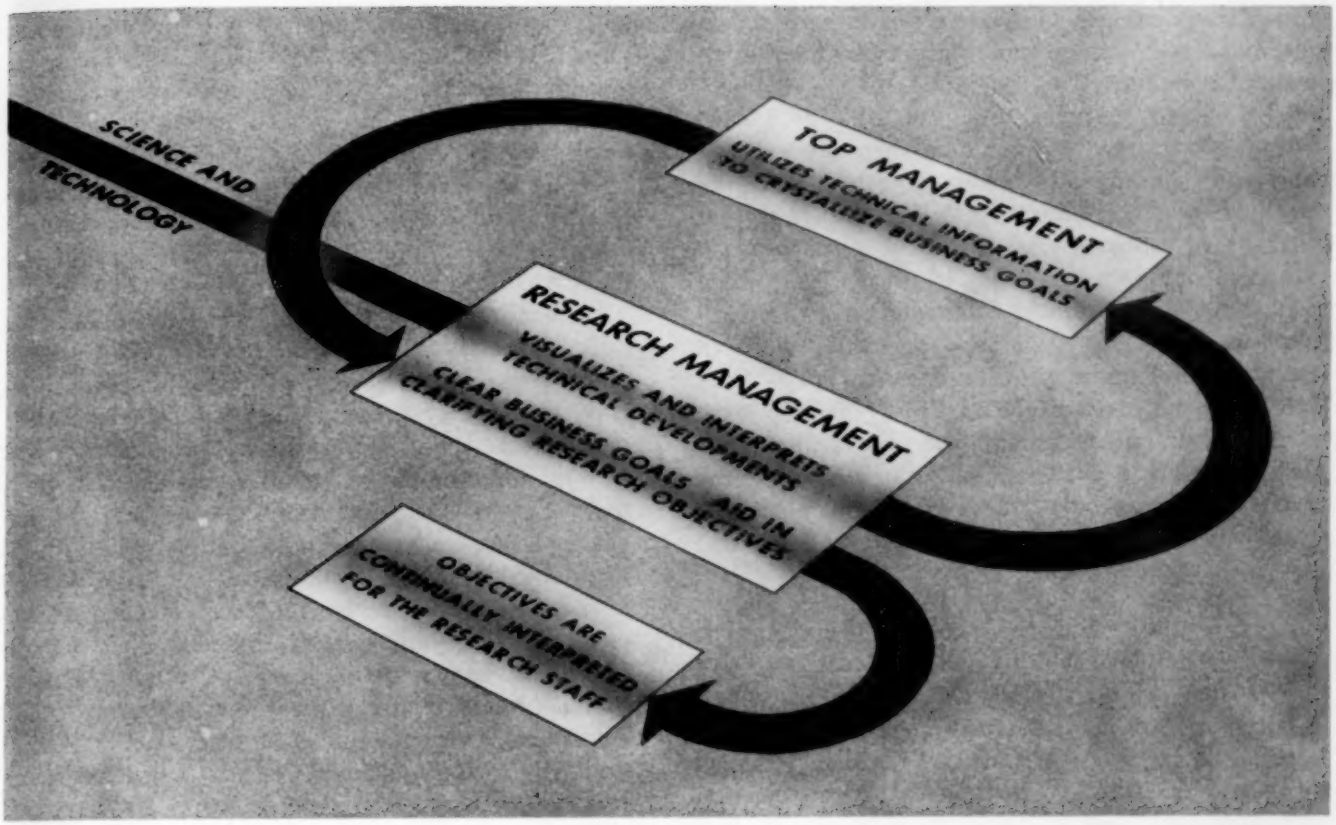
What Can Be Done to Bridge the Gulf?

Three steps that will help to bridge the gulf and improve the business role of research management are indicated below. These involve:

1. Looking ahead.
2. Crystallizing business goals.
3. Clarifying research objectives.

These avenues of improvement were selected for discussion because of their importance and because observations of industrial research organizations indicate there is considerable room for improvement in these areas.

There is almost a universal need to look ahead, visualize the possibilities of research, anticipate the technical trends influencing the business, and interpret them for top management. References in the literature on research management reflect the fact that many directors feel apart from over-all management. They feel that they have little influence in budgeting and that their suggestions regarding fruitful fields of research are given less than full weight. The logical question is—why? Is it that these research directors


SCIENCE AND TECHNOLOGY
TOP MANAGEMENT
UTILIZES TECHNICAL INFORMATION TO CRYSTALLIZE BUSINESS GOALS
RESEARCH MANAGEMENT
VISUALIZES AND INTERPRETS TECHNICAL DEVELOPMENTS
CLEAR BUSINESS GOALS AID IN CLARIFYING RESEARCH OBJECTIVES
OBJECTIVES ARE CONTINUALLY INTERPRETED FOR THE RESEARCH STAFF

One concept of how the company's research group and management can each contribute to the effectiveness of the other.

have not provided top management with well-documented speculations on the business potentialities of the several possible new fields? After all, the top executives of any firm have an incomplete picture upon which to base their business goals and business plans if they do not have a well-considered speculation of the impact of competitive research and their own research.

As Guy Suits, vice president and director of research of the General Electric Company has said, "In fact, it is important in business planning to look forward as far as possible, and to do so effectively, one must speculate about scientific progress. One should to the extent possible anticipate its probable outlines and timing and probable impact on industrial technology." Little is done in a formal way to speculate in the manner outlined by Suits and communicate these speculations to management so that business goals and business plans can be made with projections of technical trends in proper perspective. The General Electric Company is one of the several companies that make these speculations in a formal way. General Electric has a research analysis group associated with its research. The primary purpose of this group is to keep under constant surveillance the many possible avenues of research effort and interpret their possible impact on industrial technology.

Much of the work done by the economics groups of the independent research institutes and some management consulting firms is directed to providing similar analyses, projections, and speculations. All in all, this kind of looking forward might be called "pre-research communications up".

Clarifying Goals

If business goals are to be clarified, two steps must be taken—first, the goals must be formulated, then they must be interpreted and communicated. The last five years have seen a deluge of talks, seminars, and conferences on long-range planning. They have been sponsored by the American Management Association, and other management groups. Like the weather, it seems that many talk about long-range planning and few do anything about it. The other business functions—sales, production, and finance—can operate, at least in the short term, with apparent success without long-range plans. Research, on the other hand, is at a distinct disadvantage without formal long-range business objectives clearly stated. The impact of any research in the laboratory today will very likely have little effect on the business for more than a year, and more likely its impact will not be felt for five to ten

years. Every decision, every action relating to research must be based, not on conditions today, but upon conditions anticipated in the future.

Even when long-range goals and objectives have been set by an executive committee, there is often little effort made subsequently to communicate them to the remainder of the organization. It has been said that it takes two to communicate, one to speak and one to understand. In many cases it appears that when long-range plans do exist, communications are assumed to have taken place once the plans have been stated and distributed to a select few. In spite of the "talk" in management in the past five years about the merits of long-range planning, the lack of long-range plans or the inadequate communication of them to the people who must be a part of the implementation still seems to be one of the most imposing barriers to improving research management.

Selection and Statement of Technical Objectives

With the clarification of long-range business goals, it should be possible to translate them into related technical objectives. But in the selection of technical objectives, care must be taken to make sure that all areas of research relevant to the goals of the business are included; and also the converse, that all objectives selected are relevant.

In fundamental areas of investigation, the relevancy of research objectives is not easy to establish. And even when objectives are selected on technically and economically sound bases, the nontechnical person has difficulty in comprehending the logic of their selection. Yet it can be stated categorically that all major practical developments have had their beginnings in fundamental investigations. This means that the company must make certain that the whole research program is in balance, and that its work in fundamental areas of investigation is in keeping with its abilities to carry developments through to commercialization.

If speculations of technical trends are made on a continuing basis, areas of research critical to the company's future can be identified. The relevancy of objectives to the business cannot be determined precisely, but judgments can be made on logical speculations of what research might accomplish. With humorous but deadly serious logic, Guy Suits has said, "How many metallurgists have you heard of who, in the course of their research, discovered a new polymer synthesis? This leads to Rule No. 1: The results of research will be heavily weighted in the favor of the field of specialization of the investigator". Suits goes on to state, "If his research objective is clear and if he is determined to reach it, he the investigator frequently can and does make the choice that favors his objective. Because this is so, we regard the attainment of the objective as a very probable result of this investigation". His words emphasize the importance of selecting objectives that match the interests of technologists and exemplify a firm conviction that the aggressiveness and ingenuity of his scientists will generally succeed in attaining such objectives.

Off hand, one would expect that there would be no difficulty in establishing the relevancy of research objectives of a more developmental nature. Yet experience shows that greater effort is needed to steer development work into appropriate channels.

A recently completed research project with which the author was acquainted is a good example of the need to continually re-evaluate the relevancy of technical objectives. From a technical point of view, the project was well conceived, well managed, and succeeded beyond expectation in reaching the technical objective. The company supporting the project decided that it needed a specialty paper with unusual characteristics. After examining the technical objectives outlined by the technical director of the company, research chemists prepared a research program and estimated the time and costs that would be incurred. The proposed work was accepted by the sponsor and the work proceeded in an orderly fashion. At the end of the estimated time period, and within the costs, a specialty paper was developed that had the desired characteristics. Several months after the research report was presented to the sponsor, the research director had occasion to inquire about the status of the development. The answer was a shock. "The development was turned down by our sales people because they said they didn't have a distribution system for marketing it".

This article is based in part upon material which the author, William L. Swager, prepared earlier for *Business Horizons*, published by Indiana University. Since joining the Battelle staff, Swager has participated in and directed a variety of economic and other studies of interst to management. He has been associated with research problems concerned with process evaluation, cost estimation, market research, and operations research—virtually all concerned with the management and planning of research and development. This experience has given him deep insight into the important problem discussed here.

The relevancy of this technical objective obviously had not been tested prior to the undertaking of this research. In this case the research workers were working hard and ultimately successfully on an objective, but it was a "wrong objective" for this company. One of the best ways to test the relevancy of technical objectives is to ask the questions: Assume that this objective has been reached, then what? What comes next? How can the information obtained as a result of reaching the objective be used?

Objectives in Operational Terms

Not only should care be taken in a selection of technical objectives, but particular attention should be given to the way in which they are stated. Technical objectives should be stated so as to allow freedom in reaching the best technical solution. The Department of Defense has recognized the need to allow freedom for the best technical solution in the development of military weapon systems. Ten years ago, military requirements were stated in very specific terms. For example, a new fighter airplane, of an anticipated research and development program, was specified in terms of desired characteristics, such as: speed, altitude, weight, and turning radius. As research and development proceeded toward the stated objectives, technical limitations would often block the achieving simultaneously of all of the desired characteristics. The research and development men faced a choice for which they had no guide lines. They might well achieve the desired speed if the desired range could be compromised. Today, the Department specifies the objectives in terms of the mission of a new aircraft. In other words, it states what the weapon system should do and allows the research and development contractors freedom to determine the best technical approach for accomplishing the stated mission.

Clifford F. Rassweiler, vice president, Johns Manville Corporation, in his article entitled "Selecting Research Objectives", has emphasized the fact that the first step in setting a technical objective for the research organization is to find out what a product should do rather than what a product should be. Rassweiler goes on to point out that if the technical objective is stated in terms of what a product (or process) is to do "there can be no moving of the goal posts without an admission on the part of sales people (and others in the organization) that they made an incorrect analysis of the commercial situation originally".

There is another reason why technical objectives should be in "operational terms"; that is, what the product or process should do rather than what it should be. Often a laboratory measure of performance is used in initial work and subsequently becomes "the objective". Such an arbitrary measure sometimes tends to obscure the true objective. This stems from an incomplete understanding of "cause and effect". Certain technical measurements can be made that identify and measure certain of the causes. Such measurements are only crudely related to true operating performance being sought. Perhaps an example would suffice. There are abrasion-testing devices for determining the abrasion resistance of sole leather and sole materials for manufacture of shoes. This is a very crude measure of abrasion resistance and only roughly do the results of this device correlate with actual wear performance on shoes. The reason for this is rather simple; the abrasion device tests the sole material without taking into account the other variables influencing abrasion such as flexing, humidity and moisture, and rotary action. Abrasion and wear of shoes in use is quite obviously the result of the statement of an objective and an implied test method which inadequately measures progress toward the objective.

If technical objectives are stated clearly and properly, they provide the criteria by which performance is to be judged.

Technical Objectives and Business Goals

There is also a need to continually re-evaluate the relative importance of the several technical objectives with respect to the over-all business goals of the company, in order to keep a balanced and effective research effort. New technical information on new economic conditions may change the relative importance of the various business goals. These changes should also be recognized for their impact on the relative importance of the various technical objectives. The continual re-evaluation of relevancy and importance provides the criteria for controlling research. Such control, however, tends to be haphazard and at some times in error, unless there is consistent and formal planning procedure. The formal planning provides the bench mark for judging the importance and significance of changing conditions which, in turn, point to needed control actions.

Not all will agree that there are two distinct roles. Some contend that only loose direction should be given to research and the rest of the business should be alert enough to drift in the directions that develop. Such a contention obviously denies the need for the business role of research management defined above. Unfortunately, this contention fosters a substantial proportion of the "inefficiencies" that executives are concerned about today in research.

NOTES from BATTELLE

GAS-POWERED COOLING

An important step has just been taken toward future utilization of a new device for natural-gas-powered cooling of homes and commercial establishments. The device, called a free piston refrigerant compressor, has been under development at Battelle for several years. Last month the Robertshaw-Fulton Controls Company, Richmond, Virginia, announced that it had acquired an exclusive license to manufacture and market the new "cold-making" machine.

The device is a combination of a simple internal combustion engine and refrigerant compressor in a single unit having only one moving part. It was invented by technologists at Battelle, under the leadership of Rollin J. McCrory, in research sponsored by a special fund administered by the American Gas Association. The piston is called "free" because there are no mechanical links from it to the use of power. Combustion of gas takes place at one end of the cylinder, and compression of the refrigerant, such as Freon, takes place at the other. From this point, cooling action is the same as in the conventional air-conditioning unit.

Prototypes of the device have been built, and a typical system such as is used in homes has been operated successfully. Robertshaw-Fulton is sponsoring continuing studies at Battelle and will devote a substantial portion of its own research and development effort to incorporating the inventions in a commercial unit that can readily be used by any manufacturer of air-conditioning systems.

The compressor engine runs on natural gas, bottled gas, and with minor modification, on ordinary automotive gasoline. Robertshaw-Fulton anticipates that the free piston refrigerant compressor may enjoy substantial acceptance and usage in air conditioning for the home, for stores, motels and offices, and for autos, buses, trucks, and aircraft.

ZONE REFINING RARE EARTHS

The current method of separating and purifying rare-earth elements by ion exchange, is both costly and time consuming. In recent research, reported by James F. Miller and Richard C. Himes, purification by zone refining was investigated. For purposes of the study (sponsored by the Grace Research and Development Division of W. R. Grace and Company) synthetic mixtures of anhydrous rare-earth chlorides—holmium-dysprosium and yttrium-gadolinium—were prepared. Mixtures were chosen that might present a minimum of experimental difficulty and provide data that could be readily interpreted. Phase-diagram studies were also made to establish the nature of the systems and to aid in selecting the composition ranges in which zone refining would be practicable.

According to Miller and Himes, their study indicates that separation of gross mixtures of these rare-earths chlorides is not economically feasible by zone melting alone. However, zone refining of specific elements or group separations may be practical, and limited commercial processing of some elements and compounds is a possibility.

The technologists believe that additional studies on the zone refining of other binary systems and other classes of rare-earth compounds would aid in developing more efficient separations. They also point out that more study of the effects of important parameters such as zone travel rate, temperature gradient near the solid-liquid interface, and minor temperature variations would contribute to earlier use of this promising separation technique.

RADIATION STUDIES

Battelle is now accepting a larger number of requests from industry for the irradiation of specimens that will be used in research studies conducted by individual companies, reports Dr. H. R. Nelson, manager of the Institute's nuclear research activities. "Battelle", Dr. Nelson observes, "recognizes that the limited availability of reactor space has presented a real barrier for some industrial firms that might otherwise now be engaged in useful atomic research. With the assistance we are now prepared to offer, it is to be hoped that the companies will find an entree into the field of nuclear research. From experience, we have seen that an outlay of from $3,000 to $6,000 for reactor irradiation may provide a company with a whole new area of materials study

that may be pursued within the company's existing research organization."

The power level of the Battelle research reactor, in operation more than three years, was doubled earlier this year, raising its normal operating level to two million watts. Nelson points out that this power doubling of the swimming-pool type reactor was a factor in the Institute's decision to broaden the assistance which it could render. More important, he said, was the know-how in handling irradiation studies which the Battelle staff has acquired through experience. In addition to the reactor, the Battelle nuclear center, includes hot cells, a critical assembly laboratory, and a special laboratory designed especially for studies of plutonium.

* A LOOK AT NCMT'S FUTURE

One of the recent and important developments in the machine-tool field is that of numerically controlled machine tools (NCMT). These tools, controlled by numbers fed through cards or tape, are able to carry through a wide variety of tooling operations automatically and uniformly. They have generated wide interest because of their adaptability to many types of jobs. Yet their acceptance by industry seems to lag behind their proved effectiveness as production tools.

A recent survey conducted by Battelle brings to light a number of factors affecting the acceptance of these tools. It discloses, according to W. Leroy Gahm of Battelle's systems engineering division, that the major deterrent to entrance into the field of NCMT manufacture has been principally the large capital investment required of the companies. Contributing factors limiting expansion of the field are the small size of the market for such equipment and the shortage of personnel trained in technical theory and practices required in their use.

The Battelle study suggests two primary objectives for expanding the field — making the economics of NCMT more attractive and instituting an educational program to increase knowledge about and interest in numerical control and its applications.

Of the technical problems in the NCMT field, control reliability seems most troublesome, with mechanical design of tools a close second. The survey indicates that much of the control reliability problem may rest in the lack of information or know-how in the operation of the equipment rather than in the faultiness of equipment. The replies also suggest the conclusion that continued improvement in controls is desirable, especially in the direction of easier use and service. At the same time, the field would benefit by adapting machines so that they will utilize to the utmost the versatility and accuracy of the control systems becoming available.

The evidence from the survey suggests that the largest eventual market will be for general-purpose production machines, followed by machines designed for use in inspection steps. Respondents appear to agree, however, that NC machine tools are likely to prove uneconomic in repetitive mass-production operations. These machines will be designed on the basis of studies establishing optimum combinations of machining operations. At this point, it appears that the NCMT systems of the future will consist of tool systems and controls developed specifically for each other; they will be easy to program and quickly adaptable to different operations (i.e., diversified small-lot operation); control of feeds, speeds, tool changing, coolant, and the like will be automatic; and the machines will be easy to maintain. Such NCMT systems, when they can be priced within reach of shops of modest size, are likely to become quite popular and find more general use.

* Battelle staff members recently named to technical posts include: *R. J. Anderson* — member, Subcommittee on Student Membership, American Geophysical Union; *R. S. Davidson*—member (for 1960), Projects and Proposals Committee, Agricultural Research Institute, National Academy of Science—National Research Council; *R. B. Engdahl*—representative of American Society of Mechanical Engineers, Section M, American Association for the Advancement of Science *and* member, Percy Nicholls Award Committee, ASME—American Institute of Mining, Metallurgical and Petroleum Engineers; *Iver Igelsrud*—editor, CHEMICAL LITERATURE, *American Chemical* Society; *J. H. Jackson*—chairman, Program Committee (Feb. 1960-March 1961) AIME; *C. F. Lucks*—member, Subcommittees T-VI (Thermal Conductivity) and T-VII (Special Thermal Properties) of Committee C-16, American Society for Testing Materials; *R. E. Maringer*—member, Committee A-6 on Magnetic Properties, ASTM; *C. W. Townley*—member, Committee on Specifications of Radioactive Materials, ASTM.

Writings by STAFF Members

American Institute of Mining, Metallurgical and Petroleum Engineers, Metallurgical Society Transactions, v. 215, no. 5, October, 1959, contains the following writings by staff members:

Relation Between Beta Grain Size and Ductility of High-Strength Alpha-Beta Titanium Alloy. A. J. Griest, A. P. Young, and P. D. Frost, pp. 844-848.

A study was made of the effect of β grain size on the tensile ductility of α-β Ti alloys heat treated to strengths in the range 165,000 to 180,000 psi. It was concluded that the primary cause of β embrittlement is the large grain size which is obtained so rapidly in many α-β Ti alloys when heated into the β field. It was also found that grain-boundary α and acicular intragranular α in the microstructure are not necessarily detrimental to the tensile ductility if the prior β grain size is sufficiently fine.

The Effects of Sulfur on the Notch Toughness of Heat-Treated Steels. J. M. Hodge, R. H. Frazier, and F. W. Boulger, pp. 745-753.

Reports the results of studies of the impact properties of quenched and tempered alloy-steel plates as a function of sulfur content. It was found that the impact energy levels decreased continuously as the sulfur content increased and that there was a straight-line relationship between impact energy and sulfur content when plotted on logarithmic coordinates. Cross rolling raised the level of these lines for transverse tests and lowered the level for longitudinal tests proportionately to the amount of cross rolling.

Paperboard Packaging, v. 44, August, 1959, contains the following articles by staff members:

An Approach Toward Planning a Paperboard R&D Program. Leonard M. Guss and George W. James, pp. 136-141.
This study provides an intelligent approach toward determining where to spend how much for effective results and to avoid missed opportunities. It resolves how R&D can aid paperboard, how much is being spent, how much should be spent, where and for what to avoid wasteful duplication. Suggested areas of greatest promise are laminations and combinations of materials; i.e., where plastics and foils are used in conjunction with paperboard to achieve a goal neither could do, or do as well, alone.

Chemical and Coatings for Corrugated. Herbert N. Johnston, pp. 92-95.

New products, new properties, new prospects for growth of corrugated markets will result from increased application of resins and coatings to linerboard, medium, and combined board. Outlines the wide variety of materials and additives available for use, the properties they impart to the board, and how they are used.

Electron-Microscopic Observations on the Recrystallization of Nickel. W. Bollman. *Institute of Metals, Journal*, v. 87, pp. 12, August, 1959, pp. 439-443.

The various stages in the recrystallization of pure Ni were studied by transmission electron microscopy and hardness measurements. The observations on the nucleation of crystal grains can be interpreted according to the theories of Cahn and Cottrell. The appearance and origin of certain "growth zones" visible inside crystal grains are discussed.

Municipal Incinerator Refractories Practice. R. B. Engdahl and J. D. Sullivan. *American Society for Testing Materials Bulletin*, No. 240, September, 1959, pp. 52-56.

Fluctuating loads combined with the excess of air normally supplied makes it possible for the refuse charge to burn far above design rate with resulting higher temperatures and consequent overheating of refractories. When the charge is burned, the excess air rapidly cools the refractories. Damage to refractories also results from intermittent burning operations. Metal and other slag-making constituents in refuse also have a deleterious effect on refractories service. The properties of available refractories as applied to incinerators are discussed. A table showing all ASTM specifications and test methods to evaluate the properties of refractories for incinerator use is included.

Sensitivity to Vaginal Jellies. A Note on the Therapeutic Index of Spermicides. John H. Holzaepfel, John S. Warner, and Juliet A. Howard. *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, August, 1959, pp. 486-487.
In contraceptive formalations, the therapeutic index of an active ingredient must be considered as important as effectiveness alone. The therapeutic index was considered to be the ratio of the maximum nonirritating concentration in the rabbit vaginal irritation test to the minimum concentration showing instantaneous immobilization of sperm in the modified Brown and Gamble test.

New Techniques Broaden Forging Picture. II. J. H. Jackson and H. B. Goodwin. *Metal Progress*, v. 76, no. 3, September, 1959, pp. 89-94.

Cored forgings, a unique multiple-ram forging technique, high-energy forming, and improvements in conventional methods are helping to make better forgings at lower cost. Further advances are expected from fundamental studies of the forging process though research is still in the early stages. Some work has been done on the effect of impact and pressure on properties of metal, metal flow in the plastic state, and studies of die friction, die wear, and lubricants.

Flow-Induced Noise in Heat Exchangers. A. A. Putnam. *American Society of Mechanical Engineers, Transactions*, Series A, *Journal of Engineering for Power*, v. 81, no. 4, October, 1959, pp. 417-422.

Outlines the general mechanisms by which this noise is generated and presents some examples in which difficulties have been caused by the vortex-shedding phenomenon. A future course of action in handling these problems is suggested.

Growth of a Profession. B. D. Thomas. *Industrial and Engineering Chemistry*, v. 51, November, 1959, pp. 79A-80A.

Professionalism is a state of being; it is essentially an inward feeling. One becomes a professional when he begins to feel like a professional. Conversely, no formal process, no successful passing of an examination, no affiliation with a group or a society can make a professional out of a person who does not really feel himself to be one. Discusses in particular the growth of the new profession—that of the scientist-engineer—which has flourished since World War II.

The Anti-Autolytic Effect of Epinephrine in Skeletal Muscle: Non-Additive Process for Preservation of Meat. C. Radouco-Thomas, C. Lataste-Dorolle, R. Zender, R. Basset, H. M. Meyer, and R. F. Mouton. *Food Research*, v. 24, no. 5, September, October, 1959, pp. 453-482.

Shows the strong preservation effect of ante-morten epinephrine administration against post-mortem autolysis of skeletal muscle stored under asceptic and anaerobic conditions.

Joining of Beryllium. N. E. Weare and R. E. Monroe. *Light Metal Age*, v. 17, August, 1959, pp. 10-12.

Discusses some of the problems involved in the joining of this toxic and highly brittle metal. Joint surfaces must be cleaned to remove as much oxide as possible. Brazing is the most widely used joining method. Satisfactory joints can be made with Ag-base alloys as filler metal.

Members of the Battelle staff are authors of the recently published articles and books listed on these pages. In most cases, reprints are available from the Battelle Publications Office, 505 King Avenue, Columbus 1, Ohio.

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REVIEW

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AERONAUTICAL AND ASTRONAUTICAL ENGINEERING

1 Attenuation and Regeneration of Sound in Ducts and Jet Diffusers. The effect of noise regeneration by fluid flow on the performance of noise-attenuating structures is examined with special attention to muffler design. The insertion loss of a single element, as well as a continuous distribution of attenuating and noise-regenerating elements, is studied. ***Uno Ingard.*** *Acoustical Society of America, Journal*, v. 31, Sept. 1959, p. 1202-1212.

2 A Quantitative Analysis of the Characteristics and Limitations of Aerodynamic Flight Within the Atmosphere. II. Limitations. Analysis of the characteristics of the aerodynamic flight regime showed that centrifugal lift had a profound influence on the limitations of both cruising and aerospace vehicle flight, and that the effects of the variation of the earth's gravitational acceleration were negligible in this area. ***William Chester Walter.*** *Aero/Space Engineering*, v. 18, Sept. 1959, p. 63-66.

3* Design Considerations for a Sonic Fatigue Tunnel. ***R. J. Reid and J. F. Newton.*** *Aircraft and Missiles Manufacturing*, v. 2, Sept. 1959, p. 22-26.

4* Successful Research-Rocket. Slightly modified Nike booster fitted with ASP as second stage gives NRL reliable, versatile sounding rocket. ***R. Bruce Cox.*** *Aircraft and Missiles Manufacturing*, v. 2, Sept. 1959, p. 36-37.

5 Anti-Vibration Mounting of Aircraft Power Plants. Analysis of the problems associated with turbojet, turbopropeller, and reciprocating engines. ***J. F. Harriman.*** *Aircraft Engineering*, v. 31, July 1959, p. 188-191.

6 The Analysis of Fuselages of Arbitrary Cross-Section and Taper. Internal stress resultants are established for the open rings in the fuselage due to the various statically equivalent and self-equilibrating load systems. The procedure is developed for both single- and double-cell cross-sections with either singly- or doubly-connected rings. Account is given of the flexibility of a diaphragm or bulkhead, describing how either the force or displacement method may be used. ***J. H. Argyris and S. Kelsey.*** *Aircraft Engineering*, v. 31, July 1959, p. 192-203.

7 Aircraft Hydraulics. v. II. Component Design. Seals; hydraulic pumps and motors; jacks; selectors; valves; hydraulic servo-controls; pipework. ***H. G. Conway, editor.*** 198 pp. 1957. Chapman & Hall, London. (TL697.H9 C76a)

8* Drive by Heating at Supersonic Flow. Concerns the air forces which develop when heating the air around a body. (*In German.*) Antriebe mit Heizung bei Überschallgeschwindigkeit. ***K. Oswatitsch.*** *Deutsche Versuchsanstalt für Luftfahrt, Berichte*, no. 90, Mar. 1959, 29 pp.

9 Human Factors Considerations in the Design of Airport Traffic Control Quarters. Report No. 27. Preliminary Engineering Layouts. Report No. 28. Final Report. Human and structural requirements and recommendations for design and construction of consoles, instrument panels, furniture, and working conditions in an airport control tower. ***Anthony W. Silvestro, John B. Kelly, and Douglas Courtney.*** Report No. 27, June 1, 1959, 39 pp; Report No. 28, Aug. 1, 1959, 85 pp. Courtney and Company, Philadelphia. (TA175 C83r Contin.)

10 The Determination of Round-Trip Planetary Reconnaissance Trajectories. Some interesting geometrical and analytical properties of free fall trajectories are developed and subsequently exploited to provide a technique for determining interplanetary transfer orbits. A method is described for determining round-trip non-stop reconnaissance trajectories in a three-dimensional model with elliptical planetary orbits. It is found that several important features of the trajectory problem are basically three-dimensional in nature and that the simplified model is inadequate for their description. ***Richard H. Battin.*** *Journal of the Aero/Space Sciences*, v. 26, Sept. 1959, p. 545-567.

11 Similar Temperature Boundary Layers. If the wall temperature is variable, the conditions for the existence of similar

*Asterisks mark items that may be used in the Battelle Library only. None of the unbound materials listed are available for interlibrary loan.

velocity boundary layers are at the same time the conditions for the existence of similar temperature boundary layers if the wall temperature varies as a power of the local free-stream velocity or surface velocity. ***Dragutin Stojanović.*** *Journal of the Aero/Space Sciences*, v. 26, Sept. 1959, p. 571 + 4 pages.

12 Similitude of Hypersonic Real-Gas Flows Over Slender Bodies With Blunted Noses. For flows of ideal gas with constant specific heats, the requirement of the same free-stream atmosphere—i.e., the same composition, pressure, and density—can be replaced by the requirement of the same ratio of specific heats. For flows over blunted wedges or cones, special laws of similitude can be obtained. ***Hsien K. Cheng.*** *Journal of the Aero/Space Sciences*, v. 26, Sept. 1959, p. 575-585.

13 On a Class of Variational Problems in Rocket Flight. The problem considered is that of determining the direction and magnitude of the bounded thrust of a single-stage rocket, traveling in vacuum and a constant gravitational field, in order to minimize a function of the initial and final values of rocket mass, position and velocity components, and time. ***G. Leitmann.*** *Journal of the Aero/Space Sciences*, v. 26, Sept. 1959, p. 586-591.

14 Lagrange Multipliers and Quasi-Steady Flight Mechanics. For motion in a vertical plane the problem of extremizing an arbitrarily specified function of altitude, Mach Number, lift, path inclination, engine control parameter, and thrust inclination is considered for an aircraft which has to satisfy the equations of motion and 3 additional arbitrary constraints. ***Angelo Miele.*** *Journal of the Aero/Space Sciences*, v. 26, Sept. 1959, p. 592-598.

15* Present Knowledge of High Speed Transition. After a preliminary definition of a transition point, a review was made of the principal results obtained with the incompressible fluid and a separate examination of the principal factors of transition at supersonic speed, such as the Mach number, the pressure gradient, the entering edge. (*In French.*) Connaissances actuelles sur la transition aux grandes vitesses. ***R. Michel.*** *Recherche Aéronautique*, 1959, no. 71, July-Aug., p. 29-36.

16* Earth Satellites. Description of the general characteristics of near earth satellites and the scientific exploration made possible by their use as observing platforms. Sections of the paper have a bearing on the possibilities and engineering problems of space probes and space travel. ***W. H. Stephens.*** *Royal Aeronautical Society, Journal*, v. 63, July 1959, p. 394-414.

17* Theoretical Principles of Guided Missile Systems. ***E. G. C. Burt.*** *Royal Aeronautical Society, Journal*, v. 63, Aug. 1959, p. 455-464.

18* Problems of Hypersonic Aerodynamics—A Survey. In designing for the alleviation of aerodynamic heating there are two distinct cases. The first is the uncontrolled re-entry of a freely falling body, for which it is best to have a shape with a high pressure drag. The second is sustained flight, for which a shape with low pressure drag could be better, radiation giving appreciable control of surface temperature. ***R. J. Monaghan.*** *Royal Aeronautical Society, Journal*, v. 63, Sept. 1959, p. 489-492.

19* Experimental Facilities and Measuring Techniques. Aerodynamic parameters and their full-scale values; types of experimental facility; limitations of full-scale experimental facilities; uniformity of the test stream; measuring techniques. ***D. W. Holder.*** *Royal Aeronautical Society, Journal*, v. 63, Sept. 1959, p. 493-502.

20* General Characteristics of Hypersonic Flow Fields. Gives brief account of the development of the study of hypersonic flow over the past three decades, and stresses some of the ways in which hypersonic flow differs from supersonic flow. ***R. N. Cox.*** *Royal Aeronautical Society, Journal*, v. 63, Sept. 1959, p. 503-508.

21* Some Special Aspects of Hypersonic Flow Fields. Flow field between the bow wave and the blunt body; boundary layer behind the shoulder of the body; bodies at incidence. ***K. W. Mangler.*** *Royal Aeronautical Society, Journal*, v. 63, Sept. 1959, p. 508-512.

22* Aerodynamic Problems of Manned Space Vehicles. ***T. R. F. Nonweiler.*** *Royal Aeronautical Society, Journal*, v. 63, Sept. 1959, p. 521-528.

23 Research on Rotating Stall in Axial Flow Compressors. IV. A Preliminary Study of Three-Dimensional Rotating Stall. Theoretical study is made of the conditions for existence of the three-dimensional, or partial-span patterns of rotating stall of the axial flow compressor within the framework of small perturbation theory. ***F. K. Moore.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-75, Jan. 1959, 20 pp. (TL507 Un3.18w Vis.)

24* The Effect of Boundary-Layer "Fences" on the Aerodynamic Properties of Swept Wings. A barrier on a swept wing has significant beneficial effects only when, in absence of it, a strong cross-flow occurs on the wing. A "fence" can stop this cross-flow, but at the same time causes a premature separation of flow and thereby a marked drop in lift at its location. The lift distribution of the wing as well as the downwash distribution will be greatly affected by such a local loss in circulation. (*In German.*) Untersuchungen über den Einfluss von Grenzschichtzäunen auf die aerodynamischen Eigenschaften von Pfeil- und Deltaflügeln. ***Arabindo Das.*** *Zeitschrift für Flugwissenschaften*, v. 7, Aug. 1959, p. 227-242.

See also: **580** (interplanetary rocket propulsion systems).

AGRICULTURE

25* Studies on Plant Pathogenic Bacteria. I. Cultural and Biochemical Characters. II. Serology. Studies on 119 plant pathogenic bacterial strains belonging to 22 species are described. Concludes that diagnostic antisera can be useful in the identification of plant pathogenic bacteria, in epidemiological studies, and in screening isolates from plant pathogenicity tests. ***Rose Mushin, Jill Naylor, and N. Lahovary.*** *Australian Journal of Biological Sciences*, v. 12, no. 3, Aug. 1959, p. 233-246.

26 Conserving Natural Resources. Principles and Practice in a Democracy. *Shirley Walter Allen.* 2nd Ed. 370 pp. 1959. McGraw-Hill, New York. (HC55 AL54c2)

27 Principles of Farm Machinery. This book takes a strictly engineering approach to the subject of farm machinery. Stress is on the functional requirements of the basic types of field machinery, and their principles of operation. It deals with the more common types of machines and also includes general discussions of materials, power transmission, economics, and methods for testing and evaluating performance. Wherever possible, machines for a particular cultural practice—such as planting—are treated on the basis of the unit operations performed by the functional elements of the machine. ***Roy Bainer, R. A. Kepner, and E. L. Barger.*** 571 pp. 1955. John Wiley & Sons, New York. (S675 B16p)

28 Recent Advances in the Chemistry of Cellulose and Starch. The book is adapted from a lecture series at the post-graduate level. It includes sections on the molecular, crystal, and fine structure of cellulose; its degradation processes and products; cellulose modifications and derivatives; and generally similar information on starch and starch products. ***J. Honeyman, editor.*** 358 pp. 1959. Interscience Publishers, New York. (QD321 H75r)

BIOCHEMISTRY AND BIOPHYSICS

29* Biochemical Aspects of Schizophrenia. Reports that certain pineal extracts cause improvement in the biochemical disorder and a variable amount of behavioral improvement, depending on the amount of extract given and on the duration of previous hospitalization for mental disease. ***Mark D. Altschule.*** *A.M.A. Archives of Industrial Health*, v. 20, no. 4, Oct. 1959, p. 279-284.

30 Advances in Enzymology and Related Subjects of Biochemistry. Contains sections on mitochondrial metabolism, electron transport and oxidative phosphorylation, metal ion activation of enzymes, and enzymes in the synthesis of purines and pyrimidines. ***F. F. Nord, editor.*** v. XXI. 521 pp. 1959. Interscience Publishers, New York. (QP601 Ad95)

31* Some Implications of Indirect Induction Mechanisms in Carcinogenesis: A Review. ***Henry S. Kaplan.*** *Cancer Research,* v. 19, no. 8, Sept. 1959, p. 791-803.

32* The Effect of Isoantibodies *in Vivo* on Three Different Transplantable Neoplasms in Mice. ***P. A. Gorer and N. Kaliss.*** *Cancer Research,* v. 19, no. 8, Sept. 1959, p. 824-830.

33 Cancer. A popularly written account of recent research efforts aimed at finding effective cancer cures with an assessment of the achievements to date. *Chemical and Engineering News,* v. 37, no. 41, Oct. 12, 1959, p. 53-71.

34* On the Primary Site of Nuclear RNA Synthesis. Presents data indicating that nuclear RNA is synthesized on the chromosomes and is rapidly transported to the nucleoli, where the RNA remains for longer periods of time. ***Lester Goldstein and Julie Micou.*** *Journal of Biophysical and Biochemical Cytology,* v. 6, no. 2, Oct. 1959, p. 301-303.

35* Electron Microscope Study of the Development of the Papilloma Virus in the Skin of the Rabbit. Rabbit papilloma virus seems uniquely to begin its proliferation in the nucleolus of infected cells. In cells near the germinal layer of the stratum Malpighii spherical viral bodies seem to develop within a reticulum which forms out of the fine granular matrix of the nucleolus. The virus may later fill the nucleus and spread into the whole cell. The age of the cell, determined by its position in the Malpighian layer and by the extent of keratinization, can be correlated with the viral development. ***Robert S. Stone, Richard E. Shope, and Dan H. Moore.*** *Journal of Experimental Medicine,* v. 110, Oct. 1959, p. 543-546 + 6 plates.

36* Electron Microscopic Observations on the Development of Herpes Simplex Virus. Study of the J.M. strain of herpes simplex virus in human amnionic and HeLa cell tissue cultures revealed the presence of intranuclear crystals composed of viral particles with a single membrane enclosing a central body. Randomly dispersed virus with double coats was seen in the nuclear matrix and between multiple membranes at the nuclear periphery. It is suggested that this strain of virus differentiates and frequently crystallizes at template sites near the nuclear margin; that particles become enclosed by a second peripheral membrane while still within the nucleus; that the virus can pass into the cytoplasm through reduplications of the nuclear membrane which are deposited behind the virus in such a manner as to prevent rupture of the nucleus; that most of the intracytoplasmic virus is contained within sacks formed by nuclear membranes; and that rupture of these sacks at the cell surface results in extrusion of virus without disruption of the cell. No evidence was obtained to support the hypothesis that virus develops in the cytoplasm. ***Councilman Morgan, Harry M. Rose, Margaret Holden, and Ellyn P. Jones.*** *Journal of Experimental Medicine,* v. 110, Oct. 1959, p. 643-656 + 19 plates.

37* Localization of I^{131}-Labeled Antirat Lymph Node and Kidney Rabbit Antibodies in the Rat. Labeled antilymph node antibodies localized in spleen and mesenteric lymph nodes more than did labeled antikidney antibodies or labeled globulin from normal serum. In this experiment, antibodies prepared against lymphatic tissue differed qualitatively from other proteins in their lymphatic tissue localization. ***Richard Moore.*** *Journal of Immunology,* v. 83, no. 3, Sept. 1959, p. 252-256.

38* Sex Chromatin in Normal Tissues and Non-Teratomatous Tumours. Most ovarian cellular components contained well-defined sex-chromatin in two-thirds of nuclei, whereas most normal testicular tissues have a very low incidence of sex chromatin. Exceptions are the Wolffian tubules in the ovary and the efferent ducts of the testis, which frequently contain one or more sex-chromatin-like masses free in the nucleoplasm or adjacent to the nucleolus. Non-neoplastic fibroblasts in loose areolar tissue and active granulation tissue and several representative tissues from human embryos, aged 3-4 months, show a clear-cut sex difference in their nuclear morphology. In the majority of a group of 162 benign and malignant non-teratomatous tumors, the nuclear sex conformed with the sex of the bearer. ***Lois M. Myers.*** *Journal of Pathology and Bacteriology,* v. 78, no. 1, July 1959, p. 29-42.

39* Sex Chromatin in Teratomas. In females, typical female sex chromatin was identified in all well-differentiated tissues in approximately two-third of nuclei. Sex chromatin could not be identified in malignant glandular epithelium or neuroepithelium. Of 33 testicular teratomas, the nuclear sex was uniformly male in 13, uniformly female in 10, mosaic (mixed male and female) in 8 and abnormal female in 2. The occurrence of mosaic tumors appears to rule out parthenogenesis as an explanation of "female" teratomas in males. ***Lois M. Myers.*** *Journal of Pathology and Bacteriology,* v. 78, no. 1, July 1959, p. 43-55.

40* Haemophilia A in a "Girl" With Male Sex-Chromatin Pattern. Tissue culture of skin specimens and cytological studies showed 46 chromosomes and a probable XY sex chromosomal constitution. Demonstrates that seeming exceptions from sex-linked inheritance may in reality conform to the genetic pattern that would be expected. It also confirms the correctness of leucocyte sex determinations and chromosome maps, since the single X chromosome found was marked by a sex-linked genetic trait. ***Inga Marie Nilsson, S. Bergman, J. Reitalu, and J. Waldenström.*** *Lancet,* v. 2, Sept. 5, 1959, p. 264-266.

41* Chromosome Studies in Human Leukaemia. The bond-marrow chromosomes of five cases of acute leukemia were examined: one had an abnormality of chromosome number and two had morphological abnormalities alone. In contrast, no chromosomal abnormalities were found in six cases of chronic leukemia, or in two cases of myelomatosis. ***A. G. Baikie, W. M. Court Brown, Patricia A. Jacobs, and J. S. Milne.*** *Lancet,* v. 2, Sept. 26, 1959, p. 425-428.

42 The Cytopathology of Virus Infection. This series of papers is the result of a conference on *The Cytopathology of Virus Infection* held and supported by The New York Academy of Sciences in November 1958. ***Robert Love, editor.*** *New York Academy of Sciences, Annals,* v. 81, art. 1, July 21, 1959, p. 1-213. (Q11 N49a Contin.)

43 Enzymes of Polynucleotide Metabolism. This series of papers is the result of a conference on *Enzymes of Polynucleotide Metabolism* held by The New York Academy of Sciences, October 1958. Major topics include crystalline pancreatic ribonuclease, intracellular ribonucleases, polynucleotide phosphorylases, structure and properties of synthetic and other polynucleotides, and enzymes of polydesoxyribonucleotide metabolism. ***Jay S. Roth, editor.*** *New York Academy of Sciences, Annals,* v. 81, art. 3, Sept. 4, 1959, p. 511-803. (Q11 N49a Contin.)

44* The Adrenocortical Steroids. A review. ***Joseph W. Jailer.*** *Seminar Report,* v. 4, no. 3, Fall 1959, p. 2-9.

45* Induction of Immunological Tolerance to Male Skin Isografts in Female Mice Subsequent to Neonatal Period. The results reported, in which female mice are made tolerant of male skin isografts when treated with male spleen cells at an age well beyond the neonatal period, are related to relative weakness of histocompatibility barrier between males and females of these strains. Female mice will accept an intravenous injection of male spleen cells and develop a high degree of tolerance at an age when they are capable of rejecting a male skin isotransplant. The authors conjecture that this could be a function of a greater capacity of spleen cells to overcome an immunological barrier or even a relative lack of availability of transplantation antigens in spleen cells administered by this route. ***T. Mariani, C. Martinez, J. M. Smith, and R. A. Good.*** *Society for Experimental Biology and Medicine, Proceedings,* v. 101, no. 4, Aug.-Sept. 1959, p. 596-599.

46* Infectious Ribonucleic Acid Derived From Enteroviruses. RNA-containing fractions, prepared from crude tissue culture virus suspensions of six varieties of enterovirus, produced plaques on human cell monolayers. The plaque-forming agent is completely inactivated by RNAase but not by DNAase. The plaques formed by RNA fraction contain intact virus from which RNA is prepared. ***Katherine Sprunt, Winifred M. Redman, and Hattie E. Alexander.*** *Society for Experimental*

Biology and Medicine, Proceedings, v. 101, no. 4, Aug.-Sept. 1959, p. 604-608.

47* Purine Analogs as Feedback Inhibitors. ***Joseph S. Gots and Edith G. Gollub.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 4, Aug.-Sept. 1959, p. 641-643.

48* Absence of Gene Interaction in Mouse Hybrids, Revealed by Studies of Immunological Tolerance and Homotransplantation. C3H mice made tolerant by injection of A strain spleen cells at birth are tolerant of skin homografts from A strain and (A x C3H) F_1 donors. C3H mice made tolerant by injection of (A x C3H) F_1 spleen cells at birth are tolerant of skin homotransplants from both A strain and (A x C3H) F_1 donors. These observations are interpreted as evidence indicating that new histocompatibility antigens do not derive from genic interaction during hybridization in the two inbred strains of mice in these studies. ***Carlos Martinez, Fred Shapiro, and Robert A. Good.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 4, Aug.-Sept. 1959, p. 658-660.

49* Studies on Human Leukemia. Virus particles of approximately 900 Å in diameter have been observed in cells of lymph nodes from three cases of acute lymphatic-, one of acute myeloid leukemia and one of lymphosarcoma. Similar studies of sections of lymph nodes from five non-leukemic patients have failed to reveal presence of virus particles. In one patient with lymphosarcoma, not only were virus particles observed in ultrathin sections of the biopsy specimens, but also similar virus particles have been found in cells from the same specimen, grown *in vitro* for six sequential passages during which cytopathogenic changes had been observed. ***L. Dmochowski, C. E. Grey, J. A. Sykes, C. C. Shullenberger, and C. D. Howe.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 4, Aug.-Sept. 1959, p. 686-690.

50* Action of Rabies Vaccine Derived From Embryonated Duck Eggs Against Street Virus. Describes an approach to decreasing the chances of encephalomyelitis following use of rabies vaccine by preparation of vaccine from virus infected tissue initially devoid of the factors found in the rabbit brain which contribute to this type of side reaction. ***H. M. Powell and C. G. Culbertson.*** *Society for Experimental Biology and Medicine, Proceedings*, v. 101, no. 4, Aug.-Sept. 1959, p. 801-803.

51* Electrophoresis of Proteins of Irradiated Mouse Chimeras. Electrophoretic mobilities of rat proteins extracted from the bone marrow, spleen, lymph node, and thymus of chimeras and rats were similar. The quantity of rat proteins and the rate and time at which they appeared in different hematopoietic organs were quite different. Some mouse-type proteins not found in chimera tissues examined 30 days after treatment were frequently present on the 50th day or later, which suggests regression of the graft. The results are consistent with the idea that rat-type proteins synthesized in the cytoplasm of transplanted rat cells are controlled by the genotype of these cells, even in a mouse environment. ***Raymond A. Popp and L. H. Smith.*** *U. S. National Cancer Institute, Journal*, v. 23, no. 3, Sept. 1959, p. 395-402 + 4 plates.

CERAMICS AND CONCRETE

52* Some Properties of PbO-Al_2O_3-SiO_2 Glasses. A study of the firing and manufacturing properties of compositions in the range PbO 30-70%; Al_2O_3-20%, and SiO_2 5-65%. Glasses of this system have a thermal expansion from $65 \cdot 10^{-7}$ to $95 \cdot 10^{-7}$ and a satisfactory water-resistance. They are rather defective in relation to their hardness and manufacturing qualities, and have a high firing temperature. (*In Russian.*) Nekotorye svoĭstva stekol PbO-Al_2O_3-SiO_2. ***M. A. Bezborodov and M. T. Mel'nik.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 8, Aug. 1959, p. 338-340.

53 Examination of Some Refractory-Slag Reactions by Contraction Tests. Contraction data are given for MgO, $2MgO \cdot SiO_2$, $MgO \cdot Fe_2O_3$, and $MgO \cdot Cr_2O_3$ with an 8% addition of basic open-hearth slag after progressive heat-treatment; and for some basic bricks+basic slag, and for basic and high-Al_2O_3 brick+Portland cement clinker. Used bricks were taken from various areas of an open-hearth, sectioned, and tested to determine the pattern of the potential volume and melting-change characteristics. ***J. F. Hyslop.*** *British Ceramic Society, Transactions*, v. 58, June 1959, p. 329-340.

54 The Role of Anions in the Deflocculation of Clays. The part played by the anion in the deflocculation of a sodium clay by sodium silicate and Calgon was studied and, from the results, mechanisms of deflocculation were proposed. ***W. Ryan and W. E. Worrall.*** *British Ceramic Society, Transactions*, v. 58, June 1959, p. 341-352.

55 The Direct Routine Determination of Lime in Magnesite and Similar Materials. ***H. V. Thompson, editor.*** *British Ceramic Society, Transactions*, v. 58, June 1959, p. 353-386.

56 New Developments in Metals and Ceramics for High Temperature Service (Above 1000 F). Current approaches to the problems of high temperature; comparative evaluation of materials with respect to their high-temperature capabilities, potentialities, and limitations; future trends in materials research and development forecast. ***Julius J. Harwood.*** Paper from "1959 Design Engineering Conference", The American Society of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

57 Fabrication, Preparation, and Processing of Ferrite Articles. Properties and the fields of application for hard and soft magnetic materials; methods for preparing dry molded articles. The physical processes at the start of granulation are explained and some consideration devoted to the problem of molding. (*In German.*) Herstellung, Aufbereitung and Verarbeitung von Ferritmassen. ***H. B. Ries.*** *Deutsche Keramischen Gesellschaft, Berichte*, v. 36, Aug. 1959, p. 223-228.

58* Kiln Hot-Spot Hunter. The "hound" consists of a *Radiamatic* pyrometer suspended on cables alongside the kiln. The *Radiamatic* unit is driven by a synchronous motor through the cable suspension and scans the kiln shell from the front nose ring to back of the burning zone. When an extra hot—but not yet injurious—area presents itself, the scanning detector stops. It continues to "point" at that spot until the operator resets it for continued travel. *Instrumentation*, v. 12, no. 4, July-Aug. 1959, p. 8-9.

59* Temperature Measurement. With a *Radiamatic* radiation detector as a sensing element, temperatures are measured in the range from 125 to 7000 F quickly, and without the need of physically contacting the measured object or material. *Instrumentation*, v. 12, no. 4, July-Aug. 1959, p. 18-22.

60* Study with the Help of the Electron Microscope of the Structure of Hardened Cement Paste. (*In French.*) Etude a l'aide du microscope électronique de la structure de la pâte de ciment durcie. ***Juraj Stork and Vojtech Bystricky.*** *Revue des Matériaux de Construction (Edition C)*, 1959, no. 526-527, July-Aug., p. 173-179.

61* Titration of Kaolinite. Describes method for rapidly determining the kaolinite or kaolin content of a body by adding 3 to 6% of alkaline carbonate to a mixture of alkaline chlorides. The formation of an alkaline silicate of alumina is not disturbed by dehydration, since an amount of carbonate equivalent to the kaolinite present is consumed. (*In French.*) Dosage de la kaolinite par titration. ***Cirilo Jelacic.*** *Société Française de Céramique, Bulletin No.* 43, Apr.-June, 1959, p. 45-54.

62* Obtaining Pure Molten Corundum in a Solar Furnace. By fusing Bayer type industrial alumina in a solar furnace, it is possible to obtain highly pure corundums, provided certain reagents, e.g. chloridisers and reducers, are present during the operation. It is noted in particular that practically all the sodium oxide present in the initial product is eliminated. Some of the properties of the corundums obtained are examined. (*In French.*) Sur le corindon pur fondu au four solaire. ***F. Trombe and M. Foex.*** *Société Française de Céramique, Bulletin No.* 43, Apr.-June 1959, p. 69-82.

63* Abnormal Double Refraction and the Structure of Glass. A study of the variations of the amplitude of abnormal birefringence during firing and cooling of vitreous B_2O_3, borate glass (35% B_2O_3, 56% ZnO) and borosilicate glasses of the "nonex" and 3C-9 types. *(In Russian.)* Anomal'noe dvoInoe lucheprelomlenie i struktura stekla. ***O. K. Botvinkin and N. I. Ananich.*** *Steklo i Keramika*, v. 16, no. 9, Sept. 1959, p. 6-11.

64 Progress on the Use of Gas-Pressure Bonding for Fabricating Low-Cost Ceramic, Cermet, and Dispersion Fuels. Basic properties of several types and grades of commercial UO_2 were determined. Compacting characteristics of these powders were evaluated with the objective of obtaining a minimum cold-pressed density of 70% of theoretical prior to gas-pressure bonding. A small stainless-clad UO_2 flat-plate assembly was successfully pressure bonded at 2100 F for 3 hours at 10,000 psi. ***Stan J. Paprocki.*** *U. S. Atomic Energy Commission, BMI*-1372, Aug. 25, 1959, 24 pp. (UF767 U3b Contin.)

65* Investigation of the Crystallization Capacity of Glasses of the K_2O-ZnO-P_2O_5 System. The system studied offered a range of compounds giving non-hygroscopic glasses which do not crystallize when maintained for a certain length of time between 400 and 850 C. These compounds were found only with a high alkali oxide content, that is, with chemically unstable glasses. *(In Russian.)* Issledovanie kristallizatsionnoĭ sposobnosti stekol sistemy K_2O-ZnO-P_2O_5. ***T. I. Veĭnberg.*** *Zhurnal Prikladnoĭ Khimii*, v. 32, no. 8, Aug. 1959, p. 1685-1689.

CHEMICAL ENGINEERING

66 The Phase Behavior and Solubility Relations of the Benzene-Water System. The system develops in a manner usually ascribed to a partially miscible system. ***Charles J. Rebert and Webster B. Kay.*** *A.I.Ch.E. Journal*, v. 5, no. 3, Sept. 1959, p. 285-289.

67 Performance of Packed Columns. V. Effect of Solute Concentration on Gas-Phase Mass Transfer Rates. The correlation found is suitable for predicting gas-phase mass transfer coefficients. ***H. L. Shulman and L. J. Delaney.*** *A.I.Ch.E. Journal*, v. 5, no. 3, Sept. 1959, p. 290-294.

68 Particulate Fluidization and Sedimentation of Spheres. Data were taken over the Reynolds number range of 0.005 to 1,800 by means of glass spheres in both water and ethylene glycol. ***A. L. Loeffler, Jr. and B. F. Ruth.*** *A.I.Ch.E. Journal*, v. 5, no. 3, Sept. 1959, p. 310-314.

69* Scale Effect in Chemical Engineering. The correct design and operation of processes and equipment in chemical engineering depends on adequate precalculations and pilot plant experiments. In pilot plant experiments, the scale effect plays an appreciable role in that the limits of the classical principle of similarity are continuously broadened in the whole field of technical sciences. Discusses certain epistemological and methodological problems, and points to their significance from the aspect of projected economy. *(In German.)* Über den Massstabeffekt in der Chemischen Technologie. ***M. Korach.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 20, no. 3, 1959, p. 345-358.

70* Corrosion Inhibition With Sodium Nitrite. ***Jess Beecher, Charles Dinkel, and Steve Corwin.*** *American Water Works Association, Journal*, v. 51, Sept. 1959, p. 1175-1180.

71 Asbestos: Its Industrial Applications. Asbestos-cement products; tile; heat insulation; electrical insulation; friction materials; asbestos textiles; and plastics. ***D. V. Rosato.*** 214 pp. 1959. Reinhold Publishing Corp., New York. (TN930 R71a)

72 Coal Acids: New Raw Material. Useful for thermosetting foundry resins, warp sizes, and slurry thinners. *Chemical and Engineering News*, v. 37, no. 39, Sept. 28, 1959, p. 96 + 1 page.

73* The Causticisation of Sodium Sulphite Liquor. Outlines the method and considers economic and design factors. ***F. Molyneux.*** *Chemical & Process Engineering*, v. 40, Aug. 1959, p. 268-270.

74* Specific Heats of Organic Liquids. A nomogram. ***D. S. Davis.*** *Chemical & Process Engineering*, v. 40, Aug. 1959, p. 293.

75 Better Control of Heat Exchangers. Normal control; simple alternative control; cascade control; bypass; control of external heating; and condensate level control. ***Carl W. Sanders.*** *Chemical Engineering*, v. 66, Sept. 21, 1959, p. 145-148.

76 Ultrasonics Boosts Heatless Drying. Ultrasonics now looks very promising for difficult drying problems. ***R. M. G. Boucher.*** *Chemical Engineering*, v. 66, Sept. 21, 1959, p. 151-154.

77 Scale-up for Solids Processing. Case studies show why the scaling-up of solids-processing equipment is different and difficult and how to go about solving some of the problems. ***K. E. Sterrett.*** *Chemical Engineering*, v. 66, Sept. 21, 1959, p. 155-158.

78 Chart Predicts Evaporation Rates. New chart shows rate of evaporation for any fluid in a moving air stream. ***Aaron Feder.*** *Chemical Engineering*, v. 66, Sept. 21, 1959, p. 159 + 2 pages.

79 For Gas-Phase Reactors—Design for Control of Temperature. Successful control of exothermic gas reactions depends on consideration of heat-transfer limitations as well as kinetics and control system dynamics. ***Francis G. Shinskey.*** *Chemical Engineering*, v. 66, Oct. 5, 1959, p. 143-146.

80 Frontiers in Heat Transfer. Concerns such as rockets, jets, nuclear reactors, oil production with "H" bombs. ***Glenn B. Warren.*** *Chemical Engineering*, v. 66, Oct. 5, 1959, p. 147-148.

81* Experimental Investigation of Horizontal Liquid Films. The mean film thickness measured has been compared with the theoretical film thickness for laminar liquid flow and a smooth gas-liquid interface. Mean actual film thickness is about 0.6 times the theoretical one. ***J. J. van Rossum.*** *Chemical Engineering Science*, v. 11, no. 1, Aug. 1959, p. 35-52 + 1 plate.

82 Chemical Raw Material Uses for Ultra-Pure Liquid Hydrogen. Experience shows that liquid H is very safe to handle on a commercial scale. *Chemical Processing*, v. 22, Oct. 1959, p. 64-65.

83 Chemical Week Buyers' Guide Issue for 1960. Chemicals; services; equipment. *Chemical Week*, v. 85, no. 13, pt. 2, Sept. 26, 1959, 728 pp.

84* Fine Grinding With Mechanically Driven Impact Machines. Considers the operating range of the different tasks to which the impact machine is structurally suited. The effect of machine velocity on particle size is shown by several microphotographs and plots of the particle-size distribution. The effect of the flowing carrier medium on the fineness achieved is attributed to the laws governing the behavior of small particles, their specific gravity, and their shape. *(In German.)* Zur Theorie des Wärmeübergangs an nicht-Newtonsche Flüssigkeiten bei laminarer Rohrströmung. ***R. B. Bird.*** *Chemie-Ingenieur-Technik*, v. 31, Sept. 1959, p. 569-572.

85* The Counteraction of Odors. ***R. W. Moncrieff.*** *Chemistry in Canada*, v. 11, Sept. 1959, p. 66 + 3 pages.

86* Selective Hydrogenation of Olefins in Olefin-Aromatic Mixtures. The possibility of selective hydrogenation of olefins used with aromatic compounds, by means of various catalysts is investigated. For that purpose the feedstock, a mixture of hexenes and xylenes (*o*-, *p*- and *m*-xylenes), is passed in the ratio 1/1 over a pt catalyst. Describes the semi-industrial apparatus used for these continuous experiments. *(In French.)* Hydrogénation sélective des oléfines en mélange avec des composés aromatiques. ***R. M. Soemantri and H. I. Waterman.*** *Chimie & Industrie*, v. 82, no. 2, Aug. 1959, p. 181-188.

87* Metal-Ceramic Catalysts Based on Iron Oxides. I. Metal-Ceramic Catalyst for Ammonia Synthesis. By compressing and sintering, a pellet-shaped catalyst is obtained; its manufacturing process and some of its physical and mechanical properties are studied. The kinetics of the synthesis of NH_3 are then established when the reaction is carried out under atmospheric pressure, in presence of the metal-ceramic catalyst or a melted industrial catalyst. *(In French.)* Catalyseurs métallo-céramiques à base d'oxydes de fer. I. Catalyseur métallo-céramique pour la synthèse de l'ammoniac. ***I. V. Nicolescu, M. Spinzi, and A. Suceveanu.*** *Chimie & Industrie (Genie Chimique)*, v. 82, no. 2, Aug. 1959, p. 33-42.

88* Cooling Tower Fan Performance. ***George W. Forman and Neil W. Kelly.*** *Combustion*, v. 31, no. 3, Sept. 1959, p. 51-56.

89 Continuous Analysis of Chemical Process Systems. Contents generally are from manufacturers' technical bulletins and not from permanent literature. ***Sidney Siggia.*** 381 pp. 1959. John Wiley & Sons, New York. (QD131 Si23c)

90 Nitrogen Fertilisers. The sole basic feedstock is NH_3. The flowsheet is so designed that nitric acid formed by oxidation of this feedstock is absorbed at high pressure. *Engineering*, v. 188, Sept. 18, 1959, p. 217-219.

91 The Past and Future for Pipeline Transportation of Solids. History of piping solids and underlying reasons for success or failure. Economic justification must have plenty of lead time before commercial operation. ***Julian Nardi.*** *Engineering and Mining Journal*, v. 160, Sept. 1959, p. 93-97.

92* All Aluminum Cooling Tower Design. *Heat Engineering*, v. 34, no. 4, July-Aug. 1959, p. 62-63.

93 Regenerative Catalytic Reforming. Reformers utilizing Pt catalysts reduce catalyst replacement cost, increase stream efficiency, increase average yield, and provide more nearly continuous sources of H-rich gas. ***C. E. Slyngstad.*** *Industrial and Enginering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 993-996.

94 Determining Maximum Heat Load in Equipment Design. How to Find Heat Evolution Rates. Method for comparing thermal stability of various materials. ***W. R. Deason, W. E. Koerner, and R. H. Munch.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 997-1000.

95 Effects of Ring Substituents and Added Contaminants on Nitrobenzenes. *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1001-1004.

96 Flooding Characteristics and Separation Efficiencies of Pulsed Sieve-Plate Extraction Columns. ***L. D. Smoot, B. W. Mar, and A. L. Babb.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1005-1010.

97 Longitudinal Mixing in a Pulsed Sieve-Plate Extraction Column. Develops an empirical correlation for the prediction of continuous phase Peclet numbers for pulsed sieve-plate extraction columns. ***B. W. Mar and A. L. Babb.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1011-1014.

98 Polymeric Fats From Stearic, Oleic, and Short-Chain Dibasic Acids. ***R. O. Feuge and Audrey T. Gros.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1019-1022.

99 Hydrodesulfurization of Coke. Preoxidation of petroleum coke at low temperatures greatly enhances the rate of S removal upon subsequent H treating, and satisfactory desulfurization can be achieved in reasonable periods of time. ***R. Burgess Mason.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1027-1030.

100 Catalytic Reactions of Butylamines Over Alumina. Conditions during preparation of the catalyst and conditions under which it is used determine the activity in dehydrogenation and deammoniation reactions. ***Wallace S. Brey, Jr. and David S. Cobbledick.*** *Industrial and Engineering Chemistry*, v. 51, Sept. 1959, pt. 1, p. 1031-1034.

101 Physical and Chemical Properties of Nuclear Power Reactor Waste Solutions. Presents the composition and characteristics of high-level radioactive liquid wastes from the chemical processing of several important types of reactor fuel elements. What follows is part of a move to unify the efforts of workers in waste disposal. Establishment of "standard" compositions for typical wastes will make possible comparison of work done at various sites. ***W. J. Lacy, F. M. Empson, and I. R. Higgins.*** *Industrial and Engineering Chemistry*, v. 51, Oct. 1959, p. 83A-86A.

102* International 1959 Conference of the Chemical Arts. Documentary Pages of the 1959-1960 Production. A special issue of "*Chimie & Industrie*" devoted to the conference held in Paris on June 18 to 29, 1959, containing such articles as "Chemistry in Paris Through the Centuries", "The Progress of Chemistry", "Progress during the Last Ten Years in Forming Chemical Engineers and Technicians", "Technical Research in France" and "Survey of the Chemical Industry in Europe"; the book contains also a large number of summaries on plastics, perfumes, etc. *(In French.)* ***R. Vaultier, et al.*** 140 pages + 87 plates. 1959. Édition des Presses Documentaires, Paris.

103* Investigation of the Characteristics of a Sedimentation Tank by a Radioactive Tracer Technique. ***J. M. Valentine and M. M. Bluhm.*** *International Journal of Applied Radiation and Isotopes*, v. 5, no. 4, July 1959, p. 302-304.

104 Some Criteria for the *In Situ* Combustion of Crude Oil. ***P. Cooperman.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1376-1380.

105* Catalytic Cracking as One Source of Raw Material for Petrochemical Synthesis. A study of the effects of the basis parameters of catalytic cracking on the yields of finite products, and a determination of the importance of this process under present conditions. *(In Russian.)* Kataliticheskiĭ kreking kak odin iz istochnikov syr'ia dlia neftekhimicheskogo sinteza. ***A. V. Agafonov.*** *Khimiia i Tekhnologiia, Topliv i Masel*, v. 4, no. 9, Sept. 1959, p. 26-37.

106* Glycols and Polyglycols. III. Applications. Reviews uses in antifreezes, humectants, air sterilizers, brake fluids, electrolytic condensers, cosmetics and pharmaceuticals. ***Leon Raphael.*** *Manufacturing Chemist*, v. 30, Aug. 1959, p. 320-323.

107* Criticality Problems in Chemical Plant Design. Discusses fine factors that represent dangerous conditions. Explains the safety design required to alleviate these dangers. ***G. R. Hall.*** *Nuclear Power*, v. 4, Oct. 1959, p. 97-99.

108 A Practical Approach to Calculating Tank Heat Losses. Field tests and theoretical considerations are combined. ***W. D. Cowell.*** *Petroleum Engineer*, v. 31, Sept. 1959, p. C21 + 2 pages.

109 Programming Plate to Plate Distillation Calculations. A program adaptable to any medium size computer and amendable to a wide range of distillation problems. ***R. N. Maddox and J. H. Erbar.*** *Petroleum Engineer*, v. 31, Sept. 1959, p. C35 + 3 pages.

110 Need Hydrogen? Examine This Process. Gives flowsheet and some details of American Gilsonite's H plant at Boulder, Colorado. ***Norman C. Updegraff.*** *Petroleum Refiner*, v. 38, Sept. 1959, p. 175-178.

111 A Better Way to Extract Aromatics. A new solvent, sulfolane, has been tested as a substitute for diethylene glycol. Reports how well the new solvent will extract aromatics for BTX production or for motor fuel octane improvement. ***G. H. Deal, Jr., H. D. Evans, E. D. Oliver, and M. N. Papadopoulos.*** *Petroleum Refiner*, v. 38, Sept. 1959, p. 185-192.

112 Additives—A Way to Product Quality. Articles concern classes of petroleum products that take advantage of an additive's beneficial properties. *Petroleum Refiner*, v. 38, Sept. 1959, p. 203-226.

113 Now, a New Method to Figure Multicomponent Extraction. A completely rigorous method for stagewise calculations in multicomponent fractional liquid extraction is presented. ***Edward G. Scheibel.*** *Petroleum Refiner*, v. 38, Sept. 1959, p. 227-246.

114* Cooling Tower Deterioration. Describes three principal types of deterioration found in wood towers—leaching, delignification, and microbiological attack—and tells how they can be discovered by inspection. ***E. H. Hurst.*** *Plant*, v. 20, Oct. 1959, p. 25-29.

115* Dehydration of Ferric Yellow in the Fluidized Bed. Joint evaporation of liquid and dehydration of ferric yellow in the fluidized bed is possible only for low concentrations of the yellow in the suspension injected into the bed. The critical velocities of feeding and their dependence on the process parameters were determined. (*In Polish.*) Odwodnianie zółcieni żelazowej w stanie fluidalnym. ***Jerzy Roszak and Janusz Ciborowski.*** *Przemysł Chemiczny*, v. 38, no. 6, June 1959, p. 363-370.

116* Evaluation of Frothing in Sewage Treatment Plants. ***L. B. Polkowski, G. A. Rohlich, and J. R. Simpson.*** *Sewage and Industrial Wastes*, v. 31, Sept. 1959, p. 1004-1015.

117* Problems Presented by Syndets in Water Supplies. Present and future trends. ***Jesse M. Cohen.*** *Soap and Chemical Specialties*, v. 35, Sept. 1959, p. 53 + 5 pages.

118* Aerosol Sterilants. Testing ethylene oxide content of products intended for degerming heat sensitive objects. ***E. O. Haenni and R. A. Fulton.*** *Soap and Chemical Specialties*, v. 35, Sept. 1959, p. 101 + 2 pages.

119 Symposium Session on Corrosion and Water Treatment. Water treatment to inhibit corrosion; thermal insulation and corrosion; hot water and anti-freeze systems; specification problems in water treatment. ***W. L. Andrews, et al.*** 26 pp. 1959. American Society of Heating, Refrigerating and Air-Conditioning Engineers, New York. (TJ379 Am35s)

120 Symposium Session on Hydronics. Design of water piping systems; noise and vibration in water piping systems; selection of pumping equipment; and refrigerant piping. 32 pp. 1959. American Society of Heating, Refrigerating and Air-Conditioning Engineers, New York. (TH6521 Am35s)

121* Dewatering Sludge. Discusses problems of a sewage treatment plant using vacuum filtration. Improved filter operation was obtained first by use of a string discharge filter and Dacron-napped cloth, and secondly by a stainless steel woven Rotobelt. ***Walter C. Anderson.*** *Water & Sewage Works*, v. 106, Sept. 1959, p. 380-384.

122* Water & Sewage Works. Divided into 11 sections. Index includes entries for last four annual issues of this reference work. *Water & Sewage Works* (Reference Number), v. 106, Sept. 15, 1959, 528 pp.

123* Flocculation and Flotation of Aqueous Refinery Wastes. ***Peter W. Sherwood.*** *Water and Water Engineering*, v. 63, Aug. 1959, p. 378-381.

124* How New Treatment Cuts Green Wood Shrinkage. Polyethylene glycol-1000 treatment prevents end-splitting in logs. *Wood and Wood Products*, v. 64, Oct. 1959, p. 23 + 1 page.

See also: **254** (industrial gums); **405** (filters for electroplating solutions); **505** (control of fuel decomposition products); **507** (techniques in delayed coking).

CHEMISTRY—ANALYTICAL

125* Analysis of Aromatic Solvents by Gas Chromatography. Utilization of stationary phases having a high degree of selectivity for different types of hydrocarbons has made possible the determination of saturated hydrocarbons in aromatic solvents over a wide range of boiling points. Discusses the application of various stationary phases to this analysis problem and gives examples of the separations obtained. ***Bengt Smith.*** *Acta Chemica Scandinavica*, v. 13, no. 5, 1959, p. 877-883.

126* Microdetection and Colorimetric Microdetermination of Molybdenum (VI) With Morin. Molybdenum was proved to form with morin a complex compound of a brown color, readily soluble in n-butanol. The reaction is extremely sensitive in that 0.05 μg of Mo can be detected in 5 ml solution. (*In German.*) Über den Mikronachweis Und über die kolorimetrische Mikrobestimmung des Molybdäns (VI) mit Morin. ***Gy. Almássy and M. Vígvári.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 20, no. 3, 1959, p. 243-251.

127* Ozonolysis as a Method for Establishing the Position of Olefinic Linkages. Summarizes attempts to determine, in a semi-quantitative manner, the origin of unexpected cleavage products from olefinic acids. ***F. L. Benton, Arthur A. Kiess, and H. J. Harwood.*** *American Oil Chemists' Society, Journal*, v. 36, Oct. 1959, p. 457-460.

128* Paper Chromatography of 2,4-Dinitrophenylhydrazones of Saturated Aliphatic Aldehydes. Rapid method of separating the 2,4-dinitrophenylhydrazones of C_1 to C_9 aldehydes by descending chromatographic system. Method can also be used for the separation of 2,4-dinitrophenylhydrazone derivatives of ketones. ***Vasant R. Bhalerao and Fred A. Kummerow.*** *American Oil Chemists' Society, Journal*, v. 36, Oct. 1959, p. 461-463.

129* Research Methods of Analysis of Drying Oils. ***Herbert J. Dutton.*** *American Oil Chemists' Society, Journal*, v. 36, Oct. 1959, p. 513-518.

130 Ion Exchange Separation Method for Microdetermination of Tropane Alkaloids in the Presence of Morphine. Quantitative determination of micro amounts of atropine and scopolamine in the presence of large quantities of morphine. The components are first separated on an anion exchange column and the tropane alkaloids then colorimetrically determined. ***Eero Sjöström and Antti Randell.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, Aug. 1959, p. 445-448.

131 Spectrophotofluorometry of Reserpine, Other Rauwolfia Alkaloids, and Related Compounds. Excitation and fluorescent characteristics of a number of Rauwolfia alkaloids and related compounds. Procedure for the determination of reserpine in mixtures of reserpine and rescinnamine. ***R. P. Haycock, P. B. Sheth, and W. J. Mader.*** *American Pharmaceutical Association, Journal (Scientific Ed.)*, v. 48, Aug. 1959, p. 479-485.

132* A Modified Hydroxamic Acid Method for Determining Total Esterified Fatty Acids in Plasma. A colorimetric procedure. ***D. M. Morgan and K. J. Kingsbury.*** *Analyst*, v. 84, July 1959, p. 409-414.

133* The Determination of DDT Residues in Foodstuffs. Method for determining residues of DDT in a variety of foodstuffs, including fats and fatty materials. ***G. A. Sergeant and R. Wood.*** *Analyst*, v. 84, July 1959, p. 423-426.

134* Ferrous Metallurgical Analysis. A review of the analytical methods for determining Al, As, C, Cr, Co, Cu, H, Pb, Mn, Mg, Mo, Ni, Ta, Nb, N, O, P, Si, S, Sn, Ti, W, V, and Zr in steel. ***B. Bagshawe.*** *Analyst*, v. 84, Aug. 1959, p. 475-504.

135* Direct Estimation of Niobium by N-Benzoyl-N-phenylhydroxylamine. N-benzoyl-N-phenylhydroxylamine, with Nb, forms a complex of composition $NbO(C_{13}H_{10}NO_2)_3$ which is stable up to a temperature of 229 C. Niobium, thus, can be separated from Ta and other elements as this complex and weighed directly after being dried at 110 C. ***A. K. Majumdar and A. K. Mukherjee.*** *Analytica Chimica Acta*, v. 21, no. 3, Sept. 1959, p. 245-247.

136* The Polarography of Lead Styphnate. By use of a combination of normal polarography and derivative polarography using an alternating current method, it is possible to determine both Pb and styphnate ions in the same solution. ***L. R. Leake and G. F. Reynolds.*** *Analytica Chimica Acta*, v. 21, no. 3, Sept. 1959, p. 255-260.

137* Spectrophotometric Determination of Osmium. II. Sulphanilic Acid as a Reagent. Sulfanilic acid is a very effective reagent for the spectrophotometric determination of

hexavalent and octavalent Os in the pH range between 1.8-3.5. ***A. K. Majumdar and J. G. Sen Gupta.*** *Analytica Chimica Acta*, v. 21, no. 3, Sept. 1959, p. 260-265.

138 Paper Chromatography of the Saturated Fatty Acids. New procedure permits separation of small amounts of saturated acids from large amounts of unsaturated acids, and is suitable for tentative identification of the even-numbered straight-chain acids from lauric acid to lignoceric acid. ***M. A. Buchanan.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1616-1618.

139 X-Ray Fluorescence Analysis of Stainless Steel in Aqueous Solutions. Nickel, Cr, Mo, and Cb have been determined in aqueous solutions of stainless steels by X-ray fluorescence spectrometry. ***R. W. Jones and R. W. Ashley.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1629-1631.

140 Determination of Small Amounts of Secondary Amine in High Molecular Weight Fatty Primary Amines. A colorimetric method. ***A. J. Milun and J. P. Nelson.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1655-1657.

141 Quantitative Determination of Alpha-Pinene. New method named optical dilution is used for the determination. ***Robert L. Kenney, Tommy C. Singleton, and Gordon S. Fisher.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1676-1678.

142 Polarographic Determination of Residual Acrylonitrile in Polymeric Systems. Residual acrylonitrile monomer in styrene-acrylonitrile copolymer is determined polarographically in a nonaqueous system. Polarographic analysis, run directly on a N,N'-dimethylformamide solution of the polymer, avoids indirect measurement based on extraction or reprecipitation procedures. ***George C. Claver and Mary E. Murphy.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1682-1683.

143 Determination of Vinylpyridine, Acrylonitrile, and Acrylic Acid Units in Elastomeric Polymers. Modifications of the standard Kjeldahl and nonaqueous titration procedures required for the analysis of some acid and base elastomers. ***J. E. Burleigh, O. F. McKinney, and M. G. Barker.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1684-1686.

144 Improved Vacuum Fusion Gas Extraction and Collection Apparatus. Improved measurement apparatus features a large crucible for high sample capacity, a high-speed diffusion pump for rapid gas transport, provision for gas collection and measurement between 0.05 and 38 ml., an improved O-ring vacuum valve, solenoid-operated glass-mercury valves, and a butt-jointing method of assembly for rapid removal and replacement of defective components. ***Arthur Lench and G. S. Martin.*** *Analytical Chemistry*, v. 31, Oct. 1959, p. 1726-1729.

145 Resin Acids. Analysis by Mass Spectrometer (as Methyl Esters). Use of a mass spectrometer equipped with a heated inlet system to obtain a more complete picture of rosin composition. ***C. A. Genge.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1750-1753.

146 Resin Acids. Gas Chromatography of Their Methyl Esters. High temperature gas-liquid partition chromatography of resin acid methyl esters was studied on packed columns containing various polyesters and Apiezon grease as stationary phases. ***J. A. Hudy.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1754-1756.

147 Spectrophotometric Determination of Psicofuranine. Elimination of Monosaccharide Interference in the Determination of a Nucleoside. Chemical procedure for the determination of the antibiotic, psicofuranine, in the presence of its hydrolysis product, psicose, is based on elimination of psicose by reduction with sodium borohydride followed by color development on reaction of psicofuranine with diphenylamine. ***Arlington A. Forist.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1767-1768.

148 Flame Photometric Determination of Lead and Manganese in Gasoline. Determinations are accurate to about 2% of the amount present for Pb, and to about 3% for Mn. Approximately 40 Pb or 80 Mn determinations can be made per man-day. ***Garland W. Smith and Alton K. Palmby.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1798-1802.

149 Condensing System for Determination of Trace Impurities in Gases by Gas Chromatography. Simple accessory suitable for analysis of trace impurities at the p.p.m. level consists of a condenser column which can be substituted for the sampling volume tube in the Perkin-Elmer precision gas sampling system. ***Nathaniel Brenner and Leslie S. Ettre.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1815-1818.

150 Determination of Solvent Impurities in Waxes and Lubricating Oil Stocks by Gas-Liquid Chromatography. Solvent concentrations of 0.001 to 0.05% weight are currently being determined by this method, but lower or higher concentrations could be determined as well. ***Larry Randall Durrett.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1824-1825.

151 Improved Separation in Gas Chromatography by Temperature Programming. Application to Mercaptans and Sulfides. ***James H. Sullivan, John T. Walsh, and Charles Merritt, Jr.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1826-1828.

152 Polarographic Determination of Titanium in Tantalum and Niobium Concentrates and Ores. Rapid polarographic method for the determination of Ti in the range of 0.1 to 5% in Ta and Cb concentrates and ores. ***Dilip K. Banerjee, Clifford C. Budke, and Franklyn D. Miller.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1836-1839.

153 2,4,6-Tripyridyl-s-triazine as a Reagent for Iron. Determination of Iron in Limestone, Silicates, and Refractories. ***Peter F. Collins, Harvey Diehl, and G. Frederick Smith.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1862-1867.

154 Identification of Acrylate and Methacrylate Polymers by Gas Chromatography. Each acrylate and methacrylate polymer, singly and in mixtures, will produce a unique chromatogram when pyrolyzed. By heating a sample in a closed system in an inert gas and feeding the pyrolyzate directly into a gas chromatograph, it is possible to identify the original monomers. ***E. A. Radell and H. C. Strutz.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1890-1891.

155 Iodometric Microdetermination of Organic Oxidants and Ozone. Resolution of Mixtures by Kinetic Colorimetry. ***Bernard E. Saltzman and Nathan Gilbert.*** *Analytical Chemistry*, v. 31, Nov. 1959, p. 1914-1920.

156* New Ways of Polarography. The new developments aim at suppressing disturbances caused by accompanying substances and at increasing the sensitivity. This is achieved by alternating voltage polarography and improved direct voltage methods. Maximum sensitivity is obtained by the new pulse polarograph. (*In German.*) Neue Wege der Polarographie. ***M. v. Stackelberg and Helmut Schmidt.*** *Angewandte Chemie*, v. 71, nos. 15/16, Aug. 21, 1959, p. 508-512.

157* A New Method for the Spectral Analysis of Gases. Recording spectrometric procedure for the analysis of gas mixtures is described. The gases are excited in a high frequency field without using electrodes. (*In German.*) Über ein neues Verfahren zur spektralen Gasanalyse. ***Walter Koch, S. Eckhard, and F. Stricker.*** *Angewandte Chemie*, v. 71, no. 17, Sept. 7, 1959, p. 545-549.

158* Separation of Phosphoric Esters by Means of Ion Exchange Chromatography. Possibilities and limits of the chromatographic separation of phosphoric esters from acidic tissue extracts have been examined. The determination of the fractions' phosphate content allows the detection of metabolites with little or no absorption of UV-light. (*In German.*) Trennung von Phosphorsäureestern durch Ionenaustausch-Chromatographie. ***Hanns Schmitz and G. Walpurger.*** *Angewandte Chemie*, v. 71, no. 17, Sept. 7, 1959, p. 549-552.

159 Analysis of Polyester Resins by Infra-Red Spectroscopy. ***R. J. Grisenthwaite.*** *British Plastics*, v. 32, Sept. 1959, p. 428 + 2 pages.

160 Submicro-Methods for the Analysis of Organic Compounds. VI. The Determination of Carbon. VII. The Determination of Nitrogen in Heterocyclic Compounds and Azo-, Hydrazo-, and Nitro-Compounds, and in the Presence of Other Elements. VI. ***Cora W. Ayers, R. Belcher, and T. S. West.*** VII. ***R. Belcher, R. L. Bhasin, and T. S. West.*** *Chemical Society, Journal*, 1959, July-Aug., p. 2582-2587.

161* Organic Spot Tests. II. Detection of 1,2-Dihydroxy Compounds. (Differentiation of Polyhydroxy Compounds). New method of detecting the presence of two hydroxyl groups in 1,2-positions. ***Yujiro Nomura.*** *Chemical Society of Japan, Bulletin*, v. 32, no. 8, Aug. 1959, p. 889.

162* Thionyl Amines and Sulfinic Acid Amides. Under proper conditions thionyl amines are produced in satisfactory amount and not only yield sulfinic acid anilides with Grignard compounds, but also the sulfinic acid amides R'·SO·NH·R with aliphatic or cycloaliphatic R and R'. (*In German.*) Thionylamine und Sulfinsäureamide. ***Dieter Klamann, Christine Sass, and Maria Zelenka.*** *Chemische Berichte*, v. 92, no. 8, 1959, p. 1910-1913.

163* Rapid Spectrophotometric Determination of Vanadium in All Materials. It is possible to determine V contents between 0 and 1% with an absolute ±0.01% accuracy in the presence of a large variety of constituents and impurities; V conents >1% can also be determined close to ±1%. Among the constituents which may be present in all proportions are Fe, Co, Ni, Mo, Cr, and W. A short study of the statics and kinetics of the V + pyrocatechol reaction was made. (*In French.*) Dosage spectrophotométrique rapide du vanadium dans tous matériaux. ***Pierre Blanquet.*** *Chimie Analytique*, v. 41, Sept. 1959, p. 359-367.

164* Paper-Chromatography in the Field of Vegetable Oils. XXX. Paper-Chromatographic Analysis of the Glycerides. Paraffin oil or silicon oil was used as the stationary phase and acetone acetonitrile mixtures as the mobile phase. For the detection of glyceride spots, they are saponified with KOH on paper and the resulting fatty acids made visible through the normal procedure. Identification of the individual glycerides is done through elution, saponification, and subsequent separation of the fatty acids in the undecane acetic acid-acetonitrile system. Five different glycerides of soya oil were separated and quantitatively determined. (*In German.*) Die Papier-Chromatographie auf dem Fettgebiet. XXX. Mitteilung: Die pc-Analyse der Glyceride. ***H. P. Kaufmann and H. Schnurbusch.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 7, July 1959, p. 523-528.

165* Separation of Fatty Esters by Gas Chromatography. The fatty acids are first converted to their methyl esters. (*In German.*) Die gas-chromatographische Trennung von Fettsäureestern. ***A. Jart.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 7, July 1959, p. 541-546.

166* The Application of Infrared Spectrography to the Field of Fats. I. Bibliography. Pure unsaturated fatty acids and their esters were surveyed through the literature. (*In German.*) Die Anwendung der Infrarot-Spektrographie auf dem Fettgebiet I: Das Schrifttum. ***H. P. Kaufmann, F. Volbert, and G. Mankel.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 7, July 1959, p. 547-559.

167* Paper-Chromatography in the Field of Fats and Oils. XXXI. The Separation of Mixtures of Synthetic and Natural Triglycerides With the Help of Paper-Chromatography. With the help of suitable mobile phases, especially undecane/acetic acid, and by making the papyrograms hydrophobic with undecane or solid paraffin, it was possible to separate various mixtures consisting of 12 synthetic and 17 natural fats selected arbitrarily. New methods of coloration were employed to make the triglyceride spots visible. (*In German.*) Die Papier-Chromatographie auf dem Fettgebiet. XXXI. Die papierchromatographische Trennung von Gemischen synthetischer und natürlicher Triglyceride. ***H. P. Kaufmann and Z. Makus.*** *Fette, Seifen, Anstrichmittel*, v. 61, no. 8, Aug. 1959, p. 631-636.

168 Chromatographic Isolation of Citric Acid and Lactose From Skim Milk. Lactose in 70% yield was separated from citric acid by ion exchange chromatography. Purity of the lactose was determined. Citric acid was recovered in 60% yield and its purity determined. ***J. M. Lucas, J. J. Kaneko, Katsuni Hirohara, and Max Kleiber.*** *Journal of Agricultural and Food Chemistry*, v. 7, Sept. 1959, p. 638-639.

169 Salting-Out Chromatography. V. Special Resins. Partly sulfonated, crosslinked polymers of styrene absorb organic non-electrolytes from aqueous solutions more tenaciously than do the fully sulfonated cation-exchange resins. Similarly, anion-exchange resins with less than the usual amount of quaternary ammonium groups generally absorb organic non-electrolytes more tenaciously than the usual anion exchangers. Resins with quaternary ammonium groups containing ethyl, propyl, and butyl groups in place of the usual N-methyl groups were also studied. ***Gloria D. Manalo, A. Breyer, Joseph Sherma, and Wm. Rieman, III.*** *Journal of Physical Chemistry*, v. 63, Sept. 1959, p. 1511-1514.

170 The Determination of Fluoroacetic Acid and Fluoroacetamide in Plant Material. Method for determination of total organically combined F in a mixture of fluoroacetamide and fluoroacetic acid in plant material; method for determination of fluoroacetamide alone. ***C. C. Thompson.*** *Journal of the Science of Food and Agriculture*, v. 10, July 1959, p. 388-394.

171* Microdetermination of Unsaturation in Organic Compounds. Simple procedure for the microdetermination of unsaturation or hydrogen number of organic compounds which uses a palladium-on-carbon catalyst in acetic acid and a modification of the apparatus of Roth. ***M. R. Chaphekar and T. S. Gore.*** *Mikrochimica Acta*, 1959, no. 5, p. 664-669.

172* Colorimetric Method for the Estimation of Trivalent Chromium. Utilizes the colored complex formed with Complexone IV ("Chenta Acid"). ***M. R. Verma, V. M. Bhuchar, K. C. Agrawal, and R. K. Sharma.*** *Mikrochimica Acta*, 1959, no. 5, p. 766-769.

173* A Simple Method for Obtaining Melting Points of Compounds Reacting With Moisture or Oxygen. Melting point capillary is filled and closed in a dry-box and hereafter packed and fused shut outside the box. ***A. G. Pinkus and P. G. Waldrep.*** *Mikrochimica Acta*, 1959, no. 5, p. 772-774.

174* Separation of Isomer Alcohols by Means of Gas-Liquid Chromatography. I. Separation of the Saturated C_5-Alcohols. Seven compounds were separated from mixtures containing the eight possible C_5-alcohols. Better results are obtained with simpler mixtures. So far it has been impossible to separate the 2-methyl- and 3-methyl butanol pair. (*In German.*) Trennung isomerer Alkohole mittels der Gas-Flüssig-Chromatographie. I. Trennung der gesättigten C_5-Alkohole. ***Friedrich Kuffner and Dorothea Kallina.*** *Monatshefte für Chemie*, v. 90, no. 4, 1959, p. 463-466.

175 Post-Exposure Analysis of Organic Compounds in the Blood by a Rapid Infra-Red Technique. Rapid standard method for the determination of levels of circulating organic compounds foreign to the blood stream. ***R. D. Stewart, D. S. Erley, T. R. Torkelson, and C. L. Hake.*** *Nature* (Suppl. no. 4), v. 184, July 18, 1959, p. 192-193.

176 Principles and Practice of Gas Chromatography. Discusses theoretical principles underlying partition chromatography and describes the mechanism of separation when the mobile phase is an inert gas. Includes a detailed description of the mobile and stationary phases. Practical details and general procedures are described in chapters covering the effects of operational parameters, column selection and construction, sample introduction, and temperature control. ***Robert L. Pecsok, editor.*** 226 pp. 1959. John Wiley & Sons, New York. (QD271 P33p)

177* Empty Tube Combustion Methods for the Micro Elementary Analysis of Organic Compounds. Methods for the determination of C, H, S, Cl, Br, and I, and for simultaneous elemental determinations. ***J. E. Fildes.*** *Reviews of Pure and Applied Chemistry*, v. 9, no. 2, June 1959, p. 117-137.

178* Infrared Spectra and the Structure of High Polymers. Discusses interpretation of the infrared spectra of polymers, and illustrates the type of structural information that can result from complete understanding of the spectra. ***S. Krimm.*** *SPE Journal*, v. 15, Sept. 1959, p. 797-804.

179* Determination of Chlorine in Wood, Pulp and Paper. Small amounts of Cl can be determined by combustion of the material in O_2 of atmospheric pressure, adsorption of the chloride formed in water, and potentiometric titration. This method is suitable for Cl contents of more than 0.1 mg/g. ***P. O. Bethge and T. Troëng.*** *Svensk Papperstidning*, v. 62, no. 17, Sept. 15, 1959, p. 598 + 3 pages.

180 The Determination of Uranium and Molybdenum by Selective Precipitation With 8-Hydroxyquinoline. ***L. E. Storms.*** *U. S. Atomic Energy Commission, GAT-285,* July 21, 1959, 12 pp. (UF767 Un3.1ga Contin.)

181 Semiannual Progress Report for the Period July 1958 Through December 1958. Determination of U and Br; spectrophotometric determination of B in zircaloy, Zr, and Be; γ-ray spectrometry method for U^{235}; construction and application of a Frisch Grid ionization chamber to the isotopic analysis of U^{235} by α-particle spectroscopy; thermogravimetric study of the composition of U_3O_8. *U. S. Atomic Energy Commission, NBL-153,* June 1959, 63 pp. (UF767 Un3.1nb Contin.)

182* Use of Organic Reagents in Inorganic Analysis. IX. Analytical Reactions of Maleanilic Acids. Eighteen anilic acids were prepared from maleic anhydride and various aromatic amines and their properties and analytical reactions with various metal ions were studied. ***Sachindra Kumar Datta.*** *Zeitschrift für Analytische Chemie,* v. 168, no. 6, 1959, p. 418-424.

183* Determination of Nitrofurazone in Plant and Animal Tissues. The conditions of reaction of two methods to determine nitrofurazone in mixed food, animal organs, and in secretions were studied. The procedure found is safer, much improved, and more rapid. (*In German.*) Die Bestimmung von Nitrofurazon in pflanzlichen und tierischen Geweben. ***Johannes Brüggemann and Kurt Bronsch.*** *Zeitschrift für Analytische Chemie,* v. 169, no. 2, 1959, p. 88-102.

184* Coulometric Estimation of Ferricyanides. Controlled potential coulometry has been developed successfully for the estimation of ions that undergo electrode reaction with 100% current efficiency at an accurately controlled potential. ***K. S. V. Santhanam and A. P. Madhavan Nair.*** *Zeitschrift für Analytische Chemie,* v. 169, no. 2, 1959, p. 102-105.

185* Paper Chromatographic Analysis of Acids. V. Horizontal Migration Method. ***V. K. Mohan Rao.*** *Zeitschrift für Analytische Chemie,* v. 169, no. 3, 1959, p. 170-177.

186* The Application of a Magnetic Field of Low Inhomogeneity for the Quantitative Determination of Very Small Amounts of Ferromagnetic Iron by Susceptibility Measurements. The magnetic field is produced by means of specially shaped pole pieces, developed by R. A. Fereday, which allow the employment of high field values varying by only a few per cent over the range of the sample. Samples of any shape can be measured. (*In German.*) Anwendung eines Magnetfeldes schwacher Inhomogenität zur quantitativen Bestimmung geringer ferromagnetischer Beimengungen bei Suszeptibilitätsmessungen. ***Dieter-Gerstenberg.*** *Zeitschrift für Metallkunde,* v. 50, Aug. 1959, p. 472-477.

See also: **55** (determination of lime in magnesite); **61** (determination of kaolinite); **602** (automatic titrator); **603** (coulometer); **1091** (polymer characterization).

CHEMISTRY—INORGANIC AND GENERAL

187* The Crystal Structure of $TlOHSO_4(H_2O)_{2.5}$. Structure determined by means of X-ray crystallographic methods. Each Tl atom is octahedrally surrounded by six O atoms at an average distance of 2.22 Å. The Tl atoms form chains in the structure with the shortest distance between two Tl atoms equal to 4.01 Å. ***Georg Johansson.*** *Acta Chemica Scandinavica,* v. 13, no. 5, 1959, p. 925-948.

188* Studies on Molybdenum Oxides. MoO_3—MoO_2 region of the Mo-O system was investigated within the temperature range 500-870 C, by means of X-ray diffraction techniques. ***Lars Kihlborg.*** *Acta Chemica Scandinavica,* v. 13, no. 5, 1959, p. 954-962.

189 The Effect of Thorium Oxide on Thorium-Hydrogen Equilibrium. Increase in H dissociation pressure with H content, at constant temperature, in the two-phase Th-ThH_2 region is related to the dissolution of ThO_2 in ThH_2. ***David T. Peterson, D. G. Westlake, and J. Rexer.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4443-4445.

190 Preparation of Anhydrous Rare Earth Chlorides for Physicochemical Studies. A method for synthesizing anhydrous rare-earth chlorides is presented. This method, which is based on conversion of the oxides or mixtures of oxides by reaction with CCl_4 vapor at elevated temperatures, yields chlorides which appear to be superior in quality to those prepared by several other methods which have been described in the literature and were investigated in this research. ***J. F. Miller, S. E. Miller, and R. C. Himes.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4449-4451.

191 The Stereochemistry of Complex Inorganic Compounds. XXIV. Cobalt Stilbenediamine Complexes. ***Oren F. Williams and John C. Bailar, Jr.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4464-4469.

192 The Nature of Boron Hydride Solids. Reaction of diborane and decaborane in the liquid phase results in the formation of non-volatile yellow solids; no intermediate boron hydride compounds could be detected by mass spectrometry. ***I. Shapiro and Robert E. Williams.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4787-4790.

193* The Mechanism of Autoxidation of Metallo-Organic Compounds. Alkyl-metal compounds are oxidized to metalalkyl peroxides; alkali peroxide and hydrocarbon arise from the alkali adducts of aromatic hydrocarbons; aryl-metal compounds give phenols and diaryls as main reaction products. The mechanism of the primary reaction with O and of secondary and side reactions are discussed. (*In German.*) Zum Mechanismus der Autoxydation metallorganischer Verbindungen. ***H. Hock, H. Kropf, and F. Ernst.*** *Angewandte Chemie,* v. 71, no. 17, Sept. 7, 1959, p. 541-545.

194* Preparation and Definition of Silicon Nitride. The silicon nitrides defined were eventually formed by direct synthesis and from SiX_4 tetrahalides. First the Si-N system was studied, then the reactions of the SiX_4-NH_3 system, of the compounds formed, and of their successive deaminations as functions of temperature were examined. The two methods of preparation considered lead to a silicon nitride Si_3N_4. (*In French.*) Préparation et définition du nitrure de silicium. ***Michel Billy.*** *Annales de Chimie,* v. 4, July-Aug. 1959, p. 795-851.

195 The Chemical Elements. Story of the discovery of the chemical elements and all that is known of their structure. ***Helen Miles Davis.*** 2nd Ed., Rev. 198 pp. 1959. Ballantine Books, New York. (QD466 D29c2)

196 Chemistry in the Ancient World. Ancient achievements in applied chemistry. ***J. R. Partington.*** *Chemical Society, Proceedings,* 1959, Sept., p. 241-249.

197 Computers in Chemical Process Development. Different principles of operation of analogue and digital computers and how these differences affect their use and application. ***R. V. Thomas.*** *Chemical Society, Proceedings,* 1959, Sept., p. 249-261.

198* The Problem of the Composition and Structure of Potassium Cyano-Cobaltate (II). ***K. M. Abubacker and Wahid U. Malik.*** *Indian Academy of Sciences, Proceedings,* v. 50, sec. A, no. 2, Aug. 1959, p. 132-142.

199 Use of a Digital Computer for Solving a Complex Chemical Equilibrium. Applicability of digital computers to chemical problems and the technique by which they are programmed and handled by a computer. ***John W. Swinnerton and Warren W. Miller.*** *Journal of Chemical Education,* v. 36, Oct. 1959, p. 485-489.

200 The Preparation of Uranium Monocarbide and Its Heat of Formation. Preparation by direct combination of the elements. ***John D. Farr, Elmer J. Huber, Jr., Earl L. Head, and Charles E. Holley, Jr.*** *Journal of Physical Chemistry,* v. 63, Sept. 1959, p. 1455-1456.

201 Synthesis of Boron Phosphide and Nitride. Novel technique involving thermal decomposition of halide addition compounds. ***R. C. Vickery.*** *Nature* (Suppl. no. 5), v. 184, July 25, 1959, p. 268.

202 The Chemistry of Stibine. Results of the study of the preparation of stibine by the reaction of aqueous borohydride with Sb(III). Vapor pressure of stibine is given at six different temperatures. An equation of vapor pressure vs. temperature is derived which represents the data. ***Ladislav Henry Berka.*** *U. S. Atomic Energy Commission, UCRL*-8781, June 1959, 53 pp. (UF767 U3u Contin.)

203* Salting Out of Double Niobium Sulfate With Ammonium Sulfate of Sulfuric Acid Solutions in the Presence of Tantalum and Titanium. In studying the reduction of Nb, Ti, and Ta by means of a Zn amalgam in H_2SO_4 solutions in the presence of $(NH_4)_2SO_4$, the three elements are reduced in valence. The Nb reduction can be applied to its precipitation from H_2SO_4 solutions in the form of the salt $3(NH_4)_2SO_4 \cdot (NbO)_2(SO_4)_2 \cdot 2Nb_2(SO_4)_3$ in the presence of Ta and Ti. *(In Russian.)* Vysalivanie dvoĭnogo sul'fata niobiia s sul'fatom ammoniia iz sernokislykh rastvorov v prisutstvii tantala i titana. ***Ia. G. Goroshchenko, M. I. Andreeva, and A. G. Babkin.*** *Zhurnal Prikladnoĭ Khimii,* v. 32, no. 8, Aug. 1959, p. 1664-1670.

CHEMISTRY—ORGANIC

204* On the Reaction of *tert*-Butyl Chloride With Ethylene. ***Arne Brändström.*** *Acta Chemica Scandinavica,* v. 13, no. 5, 1959, p. 963-969.

205* Syntheses of Some Thiolacetic Acid Derivatives. II. Phenyl- and 1-Naphthylthiolacetic Acids. ***Bertil Sjöberg.*** *Acta Chemica Scandinavica,* v. 13, no. 5, 1959, p. 1036-1037.

206* Investigations on Catalysts. XXXII. Investigations on Raney-Nickel Catalysts. VII. Investigation of the Action of Nickel, Copper and Manganese Salts on the Hydrogenation Activity and Effectiveness of Raney-Nickel. ***Z. Csürös and J. Petró.*** *Acta Chimica Academiae Scientiarum Hungaricae,* v. 20, no. 2, 1959, p. 129-167.

207* Synthesis of Some Highly Branched Paraffin Hydrocarbons. A study of the hydration in the presence of molybdenum disulfate of tertiary alcohols and di-tertiary glycols with two isopropyl or tertiary butyl groups in hydrocarbons containing alcohol groups. *(In Russian.)* Sintez nekotorykh vysokorazvetvlennykh parafinovykh uglevodorodov. ***S. Landa, O. Veizer, E. P. Kaplan, Gao-Chin-Lan, and A. D. Petrov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 8, Aug., p. 1425-1432.

208* Studies in the Field of Nitropyrroles. III. Ultraviolet Absorption Spectra and Tautomeric Conversions of Some Nitropyrroles. It was found possible to determine the position of the NO_2-group in the pyrrole nucleus by means of UV spectroscopy. The previously accepted structure of 1 methyl-3,4-dinitropyrrole was confirmed. The acidity of the nitropyrroles studied increases with the increase of the number of the nitro groups and the shifting of these groups from the β- to the α-position. *(In Russian.)* Issledovaniia v oblasti nitropirrolov Soobshchenie. III. Ul'trafioletovye spektry pogloshcheniia i tautomernye prevrashcheniia nekotorykh nitropirrolov. ***S. S. Novikov, V. M. Belikov, Iu. P. Egorov, E. N. Safonova, and L. V. Semenov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 8, Aug., p. 1438-1444.

209* Synthesis and Reflection Spectra of N-[β-(4-Nitrophenyl)-ethyl]-aniline and N-[β-(2,4-Dinitro-phenyl)-ethyl] aniline Derivatives. All compounds obtained were deeply colored, regardless of the presence in their connecting link of two CH_2 groups excluding the possibility of an uninterrupted conjugated chain to form. Any increase in the electron donor capacity by means of a phenyl amine grouping caused a deepening of the coloration. *(In Russian.)* Sintez i spektry otrazheniia proizvodnykh N-[β-(4-nitrofenil)-etil] anilina i N-[β-(2.4-dinitrofenil)-etil] anilina. ***V. A. Izmail'skii and V. E. Limanov.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk,* 1959, no. 8, Aug., p. 1500-1504.

210* The Hardening of Phenol Formaldehyde Substances in the Presence of Dicarbonic Acids. The hardening is evidently accompanied by interaction with amino groups. Evidently the formation of a space "carcass" of H bonds between the molecules of dicarbonic acid and separate chains of resin contributes to the acceleration of gelatinization. *(In Russian.)* Otverdevanie fenolo-Formal'degidnykh Materialov v Prisytstvii Dikarbonovykh Kistlot. ***A. G. Sirota.*** *Akademiia Navuk Belaruskaia SSR, Doklady,* v. 3, no. 3, Mar. 1959, p. 91-94.

211 Infrared Spectra of Chlorophyll Derivatives. Infrared spectra of a number of chlorophyll derivatives in the 1500-3000 cm^{-1} region are presented, and important differences among chlorins, mesochlorins, porphyrins, and 2-vinylporphyrins are noted. ***H. R. Wetherell, M. J. Hendrickson, and A. R. McIntyre.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4517-4520.

212 Organic Reactions Occurring in or on Micelles. I. Reaction Rate Studies of the Alkaline Fading of Triphenylmethane Dyes and Sulfonphthalein Indicators in the Presence of Detergent Salts. II. Kinetic and Thermodynamic Analysis of the Alkaline Fading of Triphenylmethane Dyes in the Presence of Detergent Salts. ***E. F. J. Duynstee and Ernest Grunwald.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4540-4548.

213 Liquid Scintillators. VI. 2-Aryl- and 2,7-Diarylfluorenes. 2-Phenylfluorene, 2-(4-biphenylyl)-fluorene, 9-methyl-2-(4-biphenylyl)-fluorene, 2,7-diphenylfluorene, and 2,2'-bifluorene have been synthesized and screened as potential primary liquid scintillation solutes. ***Martin D. Barnett, Guido H. Daub, F. Newton Hayes, and Donald G. Ott.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4583-4586.

214 Optical Rotatory Dispersion Studies. XXV. Effect of Carbonyl Groups in Pentacyclic Triterpenes. Systematic study of the rotatory dispersion curves of pentacyclic triterpenoid ketones and aldehydes. Characteristic anomalous dispersion curves can be used for locating a carbonyl group or for determining certain stereochemical features. ***Carl Djerassi, Jeanne Osiecki, and W. Closson.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4587-4600.

215 Potential Anticancer Agents. XX. Diazoacetyl Analogs of Chlorambucil. 3-(*p*-Diazoacetylphenyl)-propionic acid was synthesized from methyl hydrocinnamate via the key intermediate, 3-(*p*-glycylphenyl)-propionic acid hydrochloride. ***W. A. Skinner, Helen F. Gram, Carol W. Mosher, and B. R. Baker.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4639-4643.

216 Synthesis and Polymerization of Methyl Substituted Vinylcyclohexanes. Synthesis of the *cis* or *trans* isomers of 2-methyl-, 3-methyl-, and 4-methylvinylcyclohexanes. The latter two compounds were polymerized to linear crystalline high polymers using aluminum triisobutyl and Ti Cl_4 in heptane. ***C. G. Overberger and J. E. Mulvaney.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4697-4701.

217 Reaction of 1,1-Diaryl-2-haloethylenes With Butyllithium. 2-Bromo-1,1-diphenylethylene reacts with butyllithium at −35 C by two competing paths: one beginning with attack on the vinyl H atom leads to rearrangement to diphenylacetylene while the other, a halogen-lithium exchange, leads on carbonation of the mixture to the formation of β,β-diphenylacrylic acid. ***David Y. Curtin and Edmund W. Flynn.*** *American Chemical Society, Journal,* v. 81, Sept. 5, 1959, p. 4714-4719.

218 The Radiation-Induced Chain Alkylation of Propylene With Isobutane. Gas phase alkylation of propylene with isobutane initiated by nuclear radiation at 55 atm. pressure and 350-400 C. ***P. J. Lucchesi and C. E. Heath.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4770-4773.

219 New Syntheses of Trialkylboranes. Triethylamineborane reacts readily with such olefins as isobutylene, 1-hexene, 1-octene, and cyclohexene in the absence of a solvent at 200 C to produce trialkylborane in yields of 77-95%. ***Eugene C. Ashby.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4791-4795.

220 Cleavage Reactions of Some Organopolysilanes. Lithium cleavage of octaphenyltrisilane in tetrahydrofuran gave a mixture of triphenylsilyllithium and pentaphenyldisilanyllithium. The latter reagent, along with triphenylsilyllithium and hepta-

phenyltrisilanyllithium, was also obtained when decaphenyltetrasilane was cleaved by Li in tetrahydrofuran. ***Dietmar Wittenberg, M. V. George, and Henry Gilman.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4812-4815.

221 Catalysis by Metal Halides. I. Mechanism of the Disproportionation of Ethyltrimethylsilane. II. The Disproportionation of Trimethylsilane, Phenyltrimethylsilane and Bromotrimethylsilane. III. The Question of the Existence of Siliconium Ions. IV. Relative Efficiencies of Friedel-Crafts Catalysts in Cyclohexane-Methylcyclopentane Isomerization, Alkylation of Benzene and Polymerization of Styrene. *Glen A. Russell.* *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4815-4838.

222 Chemistry of Cyclobutanes. II. Cyclobutenes From 3-Methylenecyclobutane-1,2-dicarboxylic Anhydride. IV. Thermal Cleavage of Methylenecyclobutanes. II. *H. N. Cripps, J. K. Williams, V. Tullio, and W. H. Sharkey.* IV. ***J. J. Drysdale, H. B. Stevenson, and W. H. Sharkey.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4904-4911.

223 Thioethers From Halogen Compounds and Cuprous Mercaptides. II. Thioethers. III. Preparation of Aromatic Di- and Tri-mercapto Compounds by Dealkylation of Aryl Alkyl Thioethers. *Roger Adams and Aldo Ferretti.* *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4927-4931 and 4939-4940.

224 Syntheses of Chlorocyclopropanes From Methylene Chloride and Olefins. Two novel reactions which strongly suggest the existence of chlorocarbene as a reaction intermediate. ***Gerhard L. Closs and Liselotte E. Closs.*** *American Chemical Society, Journal,* v. 81, Sept. 20, 1959, p. 4996-4997.

225 Some Reactions of the Allyl Radical. Energy of activation for abstraction of H from cyclopentane by allyl radicals is 31.8 ± 3.6 kcal. ***Alvin S. Gordon, S. Ruven Smith, and James R. McNesby.*** *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5059-5061.

226 The Preparation of Methoxysilanes by the Interaction of Monosilane and Methanol. Infrared spectra and other physical properties of the methoxysilanes were measured. ***Burt Sternbach and Alan G. MacDiarmid.*** *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5109-5110.

227 The Chemistry of Pyrazine and Its Derivatives. II. The Acylation of Methylpyrazine. Reactions of pyrazylmethylsodium, prepared from methylpyrazine and sodium amide in liquid ammonia, with a series of aliphatic, aromatic, and heterocyclic esters. ***John D. Behun and Robert Levine.*** *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5157-5159.

228 Pyrazines. I. Pyrazine-N-Oxides. Preparation and Spectral Characteristics. *Bernard Klein and Judith Berkowitz.* *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5160-5166.

229 Analogs of Amphenone. The Synthesis of Aminosubstituted Diphenylacetones and Related Compounds. Compounds chemically related to Amphenone were prepared. These compounds differed from Amphenone in possessing an H atom in place of the methyl group attached to the tertiary C atom. ***John B. Wright and Erwin S. Gutsell.*** *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5193-5199.

230 The Cholegenins. I. 16,22-Epoxycoprostane-3α,26,27-triol and Its Non-Identity With Dihydrocholegenin. II. Structure of Cholegenin, Isocholegenin and Dihydrocholegenin. *Malcolm J. Thompson, Irving Scheer, and Erich Mosettig.* *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5222-5230.

231 1,1,4,4-Tetrafluoro-1,2,3-butatriene. Prepared by the dehydrobromination of 1,4-dibromo-1,1,4,4-tetrafluoro-2-butene. ***E. L. Martin and W. H. Sharkey.*** *American Chemical Society, Journal,* v. 81, Oct. 5, 1959, p. 5256-5258.

232* The Chemistry of the Aminonaphthoquinones. Review article. ***Ernest Merian.*** *American Dyestuff Reporter,* v. 48, no. 20, Oct. 5, 1959, p. 31-42.

233* Derivatives of Ricinelaidic Acid. Their Infrared Spectra and Conformation of the Ricinelaidic Moiety. Compounds investigated include ricinelaidic acid, 12-ketoelaidic acid, ricinelaidyl alcohol, and their respective methyl esters and acetates. Data regarding infrared spectra and absorptivities as well as certain considerations relative to the conformation of the ricinelaidic moiety are reported. ***Marian A. McCutchon, R. T. O'Connor, Elsie F. DuPre, L. A. Goldblatt, and W. G. Bickford.*** *American Oil Chemists' Society, Journal,* v. 36, Oct. 1959, p. 450-453.

234 Reactivity of Bisulfite With a Number of Pharmaceuticals. Sympathomimetic and other drugs which are *para-* or *ortho*-hydroxybenzyl alcohol derivatives react with bisulfite to yield corresponding sulfonic acid derivatives. Both amino and nitrobenzyl alcohols similarly conjugated (e.g., chloramphenicol) also appear to be subject to similar reactions. ***Takeru Higuchi and Louis C. Schroeter.*** *American Pharmaceutical Association, Journal (Scientific Ed.),* v. 48, Sept. 1959, p. 535-540.

235* Reactions With Carbenes and Imines as Intermediates. Splitting off of N from organic molecules may lead to reactive uncharged intermediates with an electron sextet. Other modes of formation of these intermediates are shown for comparison. The interdependence of relations, structure and formation is discussed, with emphasis on reactions that can be used in preparative chemistry. *(In German.)* Reaktionen mit Carbenen und Iminen als Zwischenstufen. ***W. Kirmse.*** *Angewandte Chemie,* v. 71, no. 17, Sept. 7, 1959, p. 537-541.

236* Melting Point Diagrams of Some α-Phenyl-Substituted Dicarboxylic Acids. Melting point diagrams for mixtures of the (+)- and (−)-forms of α-phenylglutaric acid, α-phenyladipic acid, and 1,2,3,4-tetrahydro-1-naphthoic-acid. The racemic form of the first acid exists as a conglomerate whereas the two latter acids form true racemates. ***Lars Westman.*** *Arkiv för Kemi,* v. 14, no. 2, 1959, p. 115-118.

237* Synthesis and Configuration of the 3,5-Dimethylpimelic Acids and the Four Optically Active Methyl Hydrogen 3,5-Dimethylpimelates. *Lars Ahlquist, et al.* *Arkiv för Kemi,* v. 14, no. 2, 1959, p. 171-193.

238* Addition of Phenyl Isothiocyanate to Pyrroles. Pyrrole and alkyl pyrroles react spontaneously with phenyl isothiocyanate to produce C-substituted derivatives. The structures of the products are confirmed by physical methods. The reaction is catalyzed by organic bases. ***E. Bullock and R. J. Abraham.*** *Canadian Journal of Chemistry,* v. 37, Sept. 1959, p. 1391-1396.

239* Reactions of Butenes and Methyl Butenes on a Zinc Oxide Catalyst. Reactions of butene-1, isobutene, 3-methyl butene-1, and 2-methyl butene-2 on ZnO catalysts at 615 C. Formation of the observed products is discussed in terms of a sequence of surface processes incorporating dissociation of the bonds in β position to the double bond, with formation of chemisorbed allyl and substituted allyl radicals. ***M. G. Hampton and R. J. Cvetanović.*** *Canadian Journal of Chemistry,* v. 37, Sept. 1959, p. 1417-1424.

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radiation intensity forms predominantly a polymeric material. In the fraction of the reaction which forms the identifiable final products benzene and CO_2, both a direct molecular rearrangement and a free radical split to phenyl and formyl radicals occur. ***A. G. Harrison and F. P. Lossing.*** *Canadian Journal of Chemistry*, v. 37, Oct. 1959, p. 1696-1702.

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and decomposition of ethylene. The stoichiometric equations of these reactions are offered. Calculation of the tubular reactor by the method of the consecutive integration was obtained on the basis of the kinetic and stoichiometric equations. *(In Russian.)* Skorost' reaktsiĭ pri pirolize etana. ***N. L. Barabanov, I. Ia. Tiuriaev, and T. N. Mukhina.*** *Khimiia i Tekhnologiia, Toplivo i Masel,* v. 4, no. 8, Aug. 1959, p. 19-22.

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See also: **28** (chemistry of cellulose and starch).

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A more general relation based upon functions derived from heats of formation and applicable to dissolved species as well as crystals is described. ***A. D. Westland.*** *Canadian Journal of Chemistry*, v. 37, Sept. 1959, p. 1451-1455.

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307 Thermal Dissociation of TiI_2. ***D. M. Harris, M. L. Nielsen, and Gordon B. Skinner.*** *Journal of Physical Chemistry*, v. 63, Sept. 1959, p. 1484-1486.

308 The Kinetics of the Reaction Between Pu(IV) and U(IV). ***T. W. Newton.*** *Journal of Physical Chemistry*, v. 63, Sept. 1959, p. 1493-1497.

309 Thermodynamics of the Disproportionation of Titanium Tribromide. As a means of obtaining the thermodynamic properties of $TiBr_2$ from published data for $TiBr_4$ and $TiBr_3$, the disproportionation equilibrium $2TiBr_3(s) = TiBr_4(g) + TiBr_2(s)$ was studied. The partial pressure of $TiBr_4(g)$ was found to vary with the composition of the solid phase at constant temperature indicating that solid solubility occurs between $TiBr_3$ and $TiBr_2$. A value for the heat of formation of $TiBr_2$ which is thought to be the best currently available is given. ***Elton H. Hall and John M. Blocher, Jr.*** *Journal of Physical Chemistry*, v. 63, Sept. 1959, p. 1525-1526.

310 A Study of the Transference Method for the Determination of Counterion Association With Polyelectrolytes and Its Application to Poly-4-vinyl-N,*n*-butylpyridinium Bromide in Hydrogen Bromide Solutions. ***Wayne H. Martin and Quentin Van Winkle.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1539-1544.

311 Electric Properties of Macromolecules. IV. Determination of Electric and Optical Parameters From Saturation of Electric Birefringence in Solutions. ***Chester T. O'Konski, Koshiro Yoshioka, and William H. Orttung.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1558-1565.

312 Ultracentrifuge Studies With Rayleigh Interference Optics. I. General Applications. As a result of studies of some of the problems inherent in the adaptation of the Rayleigh interferometer to the ultracentrifuge, several components of the existing optical system were modified and procedures devised for their precise alignment. ***E. Glen Richards and Howard K. Schachman.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1578-1591.

313 Bubble Stability in Dimethylsilicone Solutions. Average lifetimes of bubbles on solutions of dimethylsilicones in benzene have been studied for four dimethylsilicone fluids of average molecular weights ranging from 162 to 30,000. ***Melvin H. Gottlieb.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1687-1692.

314 Hydrogen Bond Lengths and Angles Observed in Crystals. Hydrogen bond lengths observed in crystals have been classified according to the chemical groups participating in the H bond. Histograms have been drawn for those types of bond for which there is sufficient data and the mean values of bond length for the various types of bond are given. ***W. Fuller.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1705-1717.

315 Atoms and Free Radicals by γ-Irradiation at 4.2°K. In N, H, and D at 4.2 K, radiolysis produces atoms which are immobilized. They were identified by electron spin resonance. In irradiated CH_4 both H atoms and methyl radicals were found in approximately equal amounts. Repeated irradiation of the same samples in all cases led to more efficient production of active species. ***Leo A. Wall, Daniel W. Brown, and Roland E. Florin.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1762-1769.

316 Purification of Lithium Iodide by Zone Melting. Lithium iodide can be purified effectively by zone melting. The purity obtained in these experiments is not the ultimate obtainable by this method. If longer ingots and shorter zone lengths are used, or if pure ends of zone-melted ingots are refined further, an even higher level of purity can be achieved. ***F. Pizzarello.*** *Journal of Physical Chemistry*, v. 63, Oct. 1959, p. 1785-1786.

317* The Influence of Emulsifying Agent Concentration on Emulsion Viscosity. The viscosity of emulsions is affected by the concentration of the emulsifying agent normally employed in their preparation. This applies to both oil-in-water and water-in-oil systems. The effect is not constant for all emulsions that contain the same constituents irrespective of volume concentration disperse phase. On the contrary, it increases as the emulsions become more concentrated. The magnitude of the change with increasing disperse phase concentration depends on the type of emulsion and the chemical structure of the emulsifying agent. ***P. Sherman.*** *Kolloid-Zeitschrift*, v. 165, no. 2, Aug. 1959, p. 156-161.

318 The Physical Chemistry of Metallic Solutions and Intermetallic Compounds. Proceedings of a symposium held at the National Physical Laboratory in June, 1958. v. I-II, Sections individually paged. 1959. Her Majesty's Stationery Office, London. (QD171 G79p)

319* The Physico-chemical Constants of Binary Systems in Concentrated Solutions. v. 1. Two Organic Compounds Without Hydroxyl Derivatives. A compilation of literature data on mixtures of two hydrocarbons, mixtures with halogen derivatives, hydrocarbons + O derivatives, hydrocarbons + N derivatives, halogen + O and N derivatives, one O derivative + another derivative, and two N derivatives. ***Jean Timmermans.*** 1259 pp. 1959. Interscience Publishers, New York. (QD453 T48p)

320* Using Oscillations on a Small Anode for Measuring Vapor or Gas Densities. Description of a method to measure Hg vapor density within the pressure range of 10^{-3}-10^{0} mm of Hg. It is based on the dependence of the amplitude of the voltage oscillations on a small anode from the vapor density. Graduated curves for the Hg vapor and for the inert gases are plotted. (*In Russian.*) Ispol'zovanie kolebaniĭ na malom anode dlia izmereniĭ plotnosti para ili gaza. ***A. V. Rubchinskiĭ, F. S. Kobelev, and V. M. Mantrov.*** *Radiotekhnika i Elektronika*, v. 4, no. 8, Aug. 1959, p. 1311-1315.

321 Reactions of Free Radicals in the Gas Phase. Report of a symposium held at the University, Cambridge, in April, 1957. Papers are given in which a wide variety of reactions of free radicals are studied by a wide variety of methods. 239 pp. 1957. The Chemical Society, London. (QD255 C42r)

322 The Structure of Electrolytic Solutions. Covers subjects extending from dilute solutions through concentrated solutions and fused electrolytes to the pure ionic solid state. Thermodynamics and statistical mechanics are used in describing the state of ions in simple and complex media. New experimental methods for investigating the equilibria and kinetics of electrolytic solutions are included. ***Walter J. Hamer, editor.*** 441 pp. 1959. John Wiley & Sons, New York. (QD561 H17s)

323 Thermodynamic Properties of Methane. Survey of existing data. Calculation of the thermodynamic functions and construction of the diagram. ***H. E. Tester.*** 58 pp. British Petroleum Company Limited, Sunbury-on-Thames, Middlesex, England. (QD511 T28t)

324 Vistas in Free-Radical Chemistry. Surveys the major advances in free radical chemistry over the past thirty years, contains original scientific papers and indicates probable future trends. It should be of permanent value as a historical record of one of the major achievements of organic chemistry. ***W. A. Waters, editor.*** 251 pp. 1959. Pergamon Press, New York. (QD255 W31v)

325* Investigation Into the Wettability of Solid Surfaces by Polymers. Most substances with surfaces differing in character have been shown not to be wetted by polymers. This points out the completely different character of interaction between low molecular hydrocarbons and polymers and a solid surface. This is due to the fact that wetting of a solid surface by polymers is connected with change in their molecular configuration, requiring additional expenditure of energy. (*In Russian.*) Izuchenie smachivaemosti tverdoĭ poverkhnosti polimerami. ***V. A. Kargin, M. B. Konstantinopol'skaia, and Z. Iu. Berestneva.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 7, July 1959, p. 1074-1076 + 2 plates.

326* The Kirkendall Effect in the In-Tl System as a Function of Pressure. The pressure dependency observed is almost twice as high as the effect of the pressure on the autodiffusion of the two components. (*In German.*) Die Druckabhängigkeit des Kirkendall-Effektes im System In–Tl. ***D. Heitkamp.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 21, nos. 1/2, July 1959, p. 82-88.

327* The Behavior of the Diphenyl Polyenes as Electron Donors. The energy of the electron transition bands of the molecule compounds of some diphenyl polyenes with trinitrobenzene was used in determining the ionization energies of these hydrocarbons. In the case of the well conjugated diphenyl polyenes, the ionization energy decreases with the root of the number of the conjugated double bonds. (*In German.*) Das Verhalten der Diphenylpolyene als Elektronendonatoren. ***G. Briegleb, J. Czekalla, and A. Hauser.*** *Zeitschrift für Physikalische Chemie* (Frankfurt), v. 21, nos. 1/2, July 1959, p. 114-122.

328* Studies of Mixed Hydrogenating Adsorption Catalysts. II. Investigation Into the Activity of Mixed Pd-Ag Catalysts Adsorbed on SiO_2 With Respect to the Consecutive Order of Adsorption of Pd and Ag. (*In Russian.*) Issledovanie smeshannykh adsorbtsionnykh katalizatorov gidrirovaniia. II. Aktivnost' smeshannykh adsorbirovannykh na SiO_2, Pd-Ag katalizatorov v zavisimosti ot posledovatel'nosti adsorbtsii Pd i Ag. ***A. A. Alchubzhan and M. A. Mantikian.*** *Zhurnal Fizicheskoĭ Khimii*, v. 33, no. 8, Aug. 1959, p. 1691-1694.

329* The Physical Chemistry of Concentrated Ozone. VII. The Concentration Boundaries of Flame Propagation in Gaseous Mixtures of Ozone. The conditions have been studied for the propagation of flames in gaseous mixtures of ozone with O_2, N_2, CO_2, Ar, Cl_2, and vapors of CCl_4 under pressures up to 1 atm. Sharp explosibility limits exist for mixtures with O_2, N_2, CO_2 and Ar. (*In Russian.*) Fiziko-khimiia kontsentrirovannogo ozona. VII. Kontsentratsionnye granitsy rasprostraneniia plameni v gazovykh smesiakh ozona. ***V. V. Iastrebov and N. I. Kobozev.*** *Zhurnal Fizicheskoĭ Khimii*, v. 33, no. 8, Aug. 1959, p. 1701-1708.

330* Heat Content and Heat Capacities in the System Titanium-Silicon. The heat content of the silicides $TiSi_2$, TiSi, and Ti_5Si_3 and of metallic Ti have been determined in a massive calorimeter by the mixing method. On differentiating the heat content equations, expressions have been obtained for the heat capacities as a function of the temperature. (*In Russian.*) Teplosoderzhaniia i teploemkosti v sisteme titan-kremniĭ. ***Iu. M. Golutvin.*** *Zhurnal Fizicheskoĭ Khimii*, v. 33, no. 8, Aug. 1959, p. 1798-1805.

331* Thermographical Investigation of Ammonium Sulfites. The dependence of the heating curves of different sulfite specimens on their chemical compositions permits a classification of these specimens according to the character of the temperature records without any complex chemical analysis. The thermal resistance of the sulfites decreases in proportion to the increase of the hydrolysis temperature of the solutions. (*In Russian.*) Termograficheskoe issledovanie sul'fitov aliuminiia. ***P. B. Dybina.*** *Zhurnal Prikladnoĭ Khimii*, v. 32, no. 8, Aug. 1959, p. 1711-1715.

332* Study of the Mechanism and Kinetics of the Reaction of Oxidation of Tin Sulfide by Means of Air Oxygen. The investigation of this oxidation between 600 and 1000 C shows that at 900 C the oxidation is more rapid than at 950 or 1000 C. This is due, it seems, to a change in the electron structure of the atoms and to a change of the bonding forces between the molecules increasing the capacity of reaction of the substance. (*In Russian.*) Izuchenie mekhanizma i kinetiki reaktsii okisleniia sul'fida olova kislorodom vozdukha. ***D. N. Klushin and O. V. Nadinskaia.*** *Zhurnal Prikladnoĭ Khimii*, v. 32, no. 8, Aug. 1959, p. 1729-1737.

COATINGS

333* Enamels for Aluminum. Low melting plumbic enamels having a satisfactory adherence to Al were produced. The firing temperature of the enamels was between 460 and 540 C, the coefficient of thermal expansion of the best enamels was 137 to 156 x 10^{-7} cm. (*In Russian.*) Emali dlia aliuminiia. ***M. A. Bezborodov, E. E. Mazo, N. P. Grishina, and V. S. Kaminskaia.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 7, July 1959, p. 300-302.

334 Lecithin: An Important Paint Additive. Chemistry of the phospholipides and of lecithin itself are discussed together with the composition of the commercial product which bears this name. ***William Brushwell.*** *American Paint Journal*, v. 44, Oct. 5, 1959, p. 78 + 9 pages.

335 Chemistry and Industrial Utilization of Tall Oil Products. *S. T. Bauer.* *American Paint Journal*, v. 44, Oct. 12, 1959, p. 26 + 4 pages.

336* Protection Against Corrosion by Means of Metal Layers. A survey of the methods used in producing metal layers of Al, Cd, Cr, Au, In, Co, Cu, Pb, Mo, Ni, Pt, Rh, Si, Sn, Ag, and Zn by means of immersion baths, electrolysis, vaporplating, deposition by vaporization in a vacuum and other processes. (*In Dutch.*) Corrosiebescherming door metaallagen. ***T. van der Klis.*** *Bedrijf en Techniek*, v. 14e, no. 340, Sept. 19, 1959, p. 634 + 3 pages.

337 Phosphating of Iron and Steel Articles. Data on industrially used phosphate coatings intended to provide anchorage for paint films on iron and steel components. Particulars on two bath compositions for hot phosphating. Data on two cold phosphating baths. ***L. B. Shishmareva, O. Yu. Yakovleva, and V. N. Bur'yanenko.*** *Henry Brutcher Translation No.* 4641, 7 pp. (From *Stanki i Instrument*, 1958, no. 10, Oct., p. 32-33.) Henry Brutcher, Altadena, Calif.

338 Ceramic Coating for Automobile Mufflers. Car mufflers with a 100,000-mile "lifetime" warranty may soon be available. A ceramic-coated muffler available at a practical cost. *Ceramic Age*, v. 74, no. 3, Sept. 1959, p. 48-49.

339* New Ceramic Coatings. Protection at 3000° F. *Alan V. Levy.* *Ceramics*, v. 10, Aug. 1959, p. 17 + 2 pages.

340* Marine Paints and Compositions. II. Requirements of the different areas are considered. ***T. A. Banfield.*** *Corrosion Prevention & Control*, v. 6, July 1959, p. 38-40.

341 Epoxy Resins in Anti-Corrosive Applications. *P. A. Dunn.* *Corrosion Technology*, v. 6, Aug. 1959, p. 223-226.

342 Recent Developments in Materials and Finishes to Resist Atmospheric Corrosion. Advances in materials used to combat atmospheric corrosion resulting from chemical fumes, ocean spray, sunlight, and moisture are reviewed. These corrosive factors are related to the increasing demand for new coating materials to maintain good appearance at reduced cost. Reference is also made to the trend toward solvent-free and water-dispersed coating materials. Innovations in the field of electroplating include bright crackfree chromium plates, duplex nickel composites, and bronze-alloy electro-plates. New aluminum alloys which have increased the applicability of anodizing and metal-powder finishes for wire also are highlighted. ***E. B. Friedl, L. J. Nowacki, and W. H. Safranek.*** Paper from "1959 Design Engineering Conference", The American Society

of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

343* Flame Ceramic Coatings for Pistons, Valves, Heads. *Diesel Progress*, v. 25, Oct. 1959, p. 32-33.

344 Protective Coating Systems for Molybdenum. The problem of application of coated Mo at elevated temperatures is extremely complex. There are a large number of potentially useful coatings but no one coating is without fault. Laboratory evaluation of silicide, Al-Si-Cr, Ni, Cr, Ni-Cr, Al coatings, and frit-type coatings is reported. ***R. I. Jaffee.*** Paper from "Fabrication of Molybdenum", p. 119-133. 1959, American Society for Metals, Cleveland. (TN799.M7 Am35.5f)

345 Fifth International Conference on Hot Dip Galvanizing. A record of the 1958 Conference on Hot Dip Galvanizing. The 20 papers on technical progress show the development of the industry in the last 150 years and contain material published for the first time. 355 pp. 1958. Sidney Press Limited, London. (TS660 In8e)

346* Detergent Resistance of Enamels Tested and Improved. Factors influencing resistance are: firing temperature, firing time, and coloring oxide. ***F. G. Morriss.*** *Industrial Finishing (London)*, v. 11, Aug. 1959, p. 29-30.

347* Curtain Walling With Vitreous Enamelled Steel Sheet. ***T. J. Macarthur.*** *Industrial Finishing (London)*, v. 11, Aug. 1959, p. 36-38.

348* Metal Decorating by Lithography. ***Henry B. Ryan.*** *Inland and American Printer and Lithographer*, v. 143, no. 6, Sept. 1959, p. 37-39.

349 The Impact of Organic Chemistry on Metal Finishing. Nitrocellulose, solvents, plasticizers, phenolic, alkyd, amino, epoxide, vinyl, styrenated, acrylic, polyurethane, polyester, and silicone resins are reviewed. ***R. L. Yeates.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 4, Summer 1959, p. 119-127.

350* The Future of Epoxy Resins—Every Company Its Own Custom Compounder. The case for epoxy formulation by users with an explanation of epoxy properties, problems, and modifiers. ***Harold Shapiro.*** *Insulation*, v. 5, Oct. 1959, p. 13-16.

351 Texture of Evaporated NiFe Thin Films. ***R. R. Verderber.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1359-1363.

352 Selecting a Magnet Wire Enamel. ***F. A. Sattler and F. F. Trunzo.*** *Materials in Design Engineering*, v. 50, Sept. 1959, p. 102-107.

353* Organic Coatings for Aluminum. Reviews processes from cleaning and priming through to final drying. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 94 + 4 pages.

354* What's Happening in Porcelain Enameling Aluminum. A progress report. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 104 + 4 pages.

355* Modification of Alkyd Resins With Methylmethacrylate and With Acrylonitrile and Styrene. Alkyds with a 50% oil length and with a DCO:soya ratio of 50:50 or greater were successfully modified with methyl methacrylate using di-*tert*-butyl peroxide as the preferred initiator. ***Floyd Benner, et al.*** *Official Digest*, v. 31, Sept. 1959, p. 1143-1161.

356* The Properties and Application of Urethane Coatings. Two-component systems are recommended for air-dry coatings on metallic and non-metallic surfaces. Urethane coatings are generally characterized by outstanding water-resistance, abrasion resistance, very good solvent and chemical resistance, toughness, and flexibility. ***Edward R. Wells, George A. Hudson, James H. Saunders, and Edgar E. Hardy.*** *Official Digest*, v. 31, Sept. 1959, p. 1181-1210.

357* Surface Preparation Techniques for Protective Coatings. The above is one of the primary phases of a long life coating system and generally accounts for over 50% of the total painting cost. Sandblasting is the most economical method. ***Robert E. Bley.*** *Official Digest*, v. 31, Oct. 1959, p. 1257-1272.

358* Development of a Thick Paint Film Technique for Severe Exposure Conditions. A two-coat system totaling 10 to 15 mils dry thickness is described. Includes details for formulation and application. ***R. W. Stephenson.*** *Official Digest*, v. 31, Oct. 1959, p. 1293-1299.

359* Polymers Containing Fluorine. Polymers are characterized by extreme chemical inertness, great thermal stability, and excellent electrical characteristics. ***R. E. Banks and R. N. Haszeldine.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Sept. 1959, p. 591-611.

360* Organophosphorus Polymers. The structure and properties of P compounds are briefly discussed, with reference to those aspects affecting their use as components of resin systems. ***A. F. Childs and H. Coates.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Sept. 1959, p. 612-624.

361* Organic Finishes for Metal. Preparation of metals for first class organic finish coatings. ***B. M. Letsky.*** *Product Finishing*, v. 12, Aug. 1959, p. 60-62.

362* What's New in Synthetic Finishes for Furniture. A review. ***Frederick D. Johnson.*** *Product Finishing*, v. 12, Aug. 1959, p. 82-86.

363* Leveling Agents in Floor Waxes. Contains formulas and test results. ***Alfred Kroner.*** *Soap and Chemical Specialties*, v. 35, Sept. 1959, p. 95 + 3 pages.

364 Spray Deposition of Calcium Metal on Nickel or Inconel. Vapors produced during arc spraying and generally poor adhesion of the Ca to the base metal were considered the major deterrents to the process. The plasma-jet process improved bonding but further research would be necessary. ***Albert F. Haskins and Robert M. Evans.*** *U. S. Atomic Energy Commission*, BMI-1371, Aug. 24, 1959, 10 pp. (UF767 U3b Contin.)

365* Effect of Light and Water on the Degradation of Asphalt. ***L. R. Kleinschmidt and H. R. Snoke.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 63C, no. 1, July-Sept. 1959, p. 31-36.

366* Polyethylene on Wire. Production of telephone cable insulated with polyethylene. *Wire Industry*, v. 26, Aug. 1959, p. 767.

See also: **64** (stainless steel cladding of VO_2 fuel elements); **664** (effects of short blasting on enamel boil defects); **1050** (plastics for protection against corrosion); **1086** (flame-retardant polyethylene for wire).

CONTROL SYSTEMS, COMPUTERS, AND SYSTEMS ENGINEERING

367* Central-European Computers. ***Nelson M. Blachman.*** *Association for Computing Machinery, Communications*, v. 2, Sept. 1959, p. 14-18.

368* Survey of Progress and Trend of Development and Use of Automatic Data Processing in Business and Management Control Systems of the Federal Government, as of December 1957. III. *Association for Computing Machinery, Communications*, v. 2, Sept. 1959, p. 34-43.

369 Electrical Linkages for Computing Equipment. A technique is established whereby electrical analogues of straight-bar plane linkages may be constructed. They represent a practical way of realizing a large class of function generators for use in analogue computers. ***Arthur A. Hauser, Jr.*** *Automatic Control*, v. 11, no. 3, Sept. 1959, p. 1DC-6DC.

370 Design of Transistorized Circuits for Digital Computers. Basic building blocks, logical chains in digital computers, transistor fundamentals, transistor transient response, diode gating, voltage-switching diode gate logic, current switching with transistor, resistance logic and other related parts

are discussed. ***Abraham I. Pressman.*** 316 pp. 1959. John F. Rider Publisher, Inc., New York. (TK7888.3 P92d)

371 The Outlook for Computer Control. The future of computer control for the process industries looks bright, but its full potential will not be realized until the process itself is susceptible to such control. ***I. M. Stein.*** *Electrical Engineering*, v. 78, Oct. 1959, p. 990-995.

372 Data-Gathering in Continuous Chemical Processing. Discusses process control instruments and automatic data-handling equipment. ***P. D. Schnelle.*** *IRE Transactions on Industrial Electronics, PGIE*-10, July 1959, p. 8-23. (TK1 In6.6ie Vis.)

373 Application of Data-Logging and Programming Techniques to Steel Mill Processes. Programming and data logging for reverse-hot-mill, tandem mill, and processing line. Shift register for transport delay. Annealing lines. ***R. W. Barnitz and G. E. Terwilliger.*** *IRE Transactions on Industrial Electronics, PGIE*-10, July 1959, p. 24-32. (TK1 In6.6ie Vis.)

374* Approximating Probability Distributions to Reduce Storage Requirements. The approximation method is based on an information measure for the "closeness" of two distributions and on the criterion of maximum entropy. Approximations consisting of products of appropriate lower order distributions are proved to be optimum under suitably restricted conditions. ***P. M. Lewis.*** *Information and Control*, v. 2, no. 3, Sept. 1959, p. 214-225.

375* The Informational Content of Mechanisms and Circuits. Presents methods for calculation of the informational content, i.e., complexity, of interacting systems of parts in mechanisms and circuits, which were developed primarily in order to describe self-reproducing systems but can be applied to any mechanism or circuit. ***Homer Jacobson.*** *Information and Control*, v. 2, no. 3, Sept. 1959, p. 285-296.

376 Introduction to the Design of Servomechanisms. Basic concepts, mathematical introduction, harmonic analysis, feed back, the Nyquist criterion, the Bode diagram, series equalizers, performance criteria and design techniques, minor loops, the root-Locus technique, statistical considerations, nonlinearities in servomechanism design, some servomechanism components and their transfer functions, are discussed. ***John L. Bower and Peter M. Schultheiss.*** 510 pp. 1958. John Wiley & Sons, New York. (TJ214 B67i)

377* A Simplified Theory of Feedback Control Systems. XIII. Considers a method of transient computation known as the slope-line method of integration. ***P. Naslin.*** *Process Control and Automation*, v. 6, July 1959, p. 308-314.

378* A Simplified Theory of Feedback Control Systems (Part 14). Numerical simulation of transients in linear and non-linear systems. ***P. Naslin.*** *Process Control and Automation*, v. 6, Aug. 1959, p. 352-357.

379 Programming the IBM 650 Magnetic Drum Computer and Data-Processing Machine. Simple programming, the 650 console, more advanced programming, easy programming via sub-routines, soap, a re-examination of principles, interpretive systems, compilers, odds and ends are discussed. ***Richard V. Andree.*** 114 pp. 1958. Henry Holt and Company, Inc., New York. (QA76.5 An25p)

380* An Electrical Analogue for Dead Time. The performance of a control loop is often greatly affected by elements having dead time. Consequently, analogue computers for investigating control loops must be equipped for the inclusion of dead time elements. This article surveys briefly the various methods of simulating dead time and describes a device developed for this purpose. *(In German.)* Ein elektrisches Analogiegerät für Totzeiten. ***G. Heller.*** *Regelungstechnik*, v. 7, no. 8, Aug. 1959, p. 266-269.

381* A Method for the Numerical Calculation of the Original Functions From the Given Component Describing Functions. A method is shown which enables the original function of a component-describing function to be expressed in the form of a series, thus eliminating the laborious determination of the roots of the denominator polynomial. An example illustrates how well the derived series converges. *(In German.)* Ein Verfahren zur numerischen Berechnung von Originalfunktionen bei gegebenen gebrochen rationalen Bildfunktionen. ***R. Hofmann.*** *Regelungstechnik*, v. 7, no. 8, Aug. 1959, p. 269-271.

382* The Optimum Setup for Control Systems With Dead Time. The transient response of the deviation resulting from a step disturbance of the output of a controlled plant has been calculated for several types of control loop containing dead time, by the use of exponential series of the Laplace transform. The results have been used to determine the settling time corresponding to the prescribed tolerance limits. A thorough investigation of the general integral control system leads to the conclusion that the ideal integral system does not represent the optimum system for a control loop with dead time. For each finite tolerance limit ϵ there is a value $a < 1$ which enables shorter settling times to be obtained. Settling times following a step disturbance will be shortest if a PI system is used. A reduction of the settling time either by the use of derivative action or second order integral action is stated to be impossible. If it is required to smooth out slow periodic fluctuations or to correct for irregular disturbances, there is no more favorable arrangement for a control loop with dead time than a second order PI system. *(In German.)* Über die optimale Bemessung von Regelsystemen mit Laufzeit. ***H. Schliessmann.*** *Regelungstechnik*, v. 7, no. 8, Aug. 1959, p. 272-280.

383 Digital Start-Up Control for Aircraft Reactors. A start-up channel is described which retains present analog sensing techniques and replaces relays and vacuum tubes by digital transistor logic. It is concluded that this instrumentation will result in considerable reduction in size and weight and increased reliability. *U. S. Atomic Energy Commission, NYO*-8586, Mar. 12, 1958, 26 pp. (UF767 U3ny Contin.)

See also: **197** (chemical process computers); **199** (application of computers to chemical problem); **473** (operations with automation); **722** (automation in machine shops); **1177** (automatic feedback control of spot welding).

ELECTRICAL ENGINEERING

384* The Life Expectancy of Class A Random-Wound Motor Insulation as Determined by AIEE Standard No. 510 Test Procedure. The present-day insulation systems, for general-purpose random-wound motors built in accordance with American Standards, have an extrapolated life of somewhere between 5,000 and 15,000 hours at 105 C. *Applications and Industry*, 1959, no. 44, Sept., p. 224-228.

385* The Effect of Variable High-Altitude Humidity on the Wear of Nondusting Brushes. Previously unexplained cases of erratic brush wear on actual flights can now be explained by the range of fluctuations which may occur in the humidity of the atmosphere at present flight altitudes. ***L. E. Moberly and J. L. Johnson.*** *Applications and Industry*, 1959, no. 44, Sept., p. 263-267.

386* Development of Fuses and Terminals for High-Temperature Applications. At the present stage of development it appears that terminals and splices will be of the crimp type, made of Cu or Ni. The high-temperature fuse will be visually indicating, with a one-piece ceramic housing. ***W. F. Bonwitt and H. Buttner.*** *Applications and Industry*, 1959, no. 44, Sept., p. 267-272.

387* The Frequency Behavior of Hall Generators. The eddy currents induced by the RF alternating field in the semiconductor plate effect an increase in the Hall voltage with increasing frequency. A phase lead of the Hall voltage with respect to the applied magnetic alternating field takes place as well. Amplitude increase and phase lead occur only if the semiconductor layer of the Hall generator is embedded into ferrite at either side, i.e., the air gap height δ equals the thickness d of the semiconductor layer. *(In German.)* Über das Frequenzverhalten von Hallgeneratoren. ***Friedrich Kuhrt, Hans-Joachim Lippmann, and Klemens Wiehl.*** *Archiv der Elektrischen Übertragung*, v. 13, Aug. 1959, p. 341-347.

388 Mathematics of Insulation-Aging Calculations. Insulation aging rate is based on the use of the Arrhenius chemical reaction rate theory, which relates insulation deterioration to the reciprocal of the absolute temperature. All aging values are in terms of relative aging. ***L. C. Whitman and W. W. Whitman.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 308-318.

389* Compensation Transformer for the Measurement of Heavy Direct Currents. Heavy direct currents up to more than 100 kA were measured with great accuracy (error 10^{-3} to 10^{-4}). These transformers are suitable for calibrating D. C. transformers of other types and for the accurate measurement of direct currents in laboratories in cases where the error can be measured direct in absolute units with an accurate moving coil instrument. *(In German.)* Kompensationswandler zur Präzisionsmessung hoher Gleichströme. ***Ludwig Abraham and Klemens Heumann.*** *ETZ: Elektrotechnische Zeitschrift*, v. 80, Ausgabe A, no. 18, Sept. 1959, p. 629-632.

390 An Elementary Design Discussion of Thermoelectric Generation. *E. W. Bollmeier.* *Electrical Engineering*, v. 78, Oct. 1959, p. 995-1002.

391 Space Electric Power Transmission. To provide shielding for crews of manned space vehicles utilizing nuclear sources, considerable distance between the power source and vehicle may be necessary. Design problems are discussed. ***G. W. Bills.*** *Electrical Engineering*, v. 78, Oct. 1959, p. 1021-1024.

392 Electrical Engineering Materials. Dielectric, magnetic, and conductive properties of materials, including a discussion of semiconductors and transistors. ***Adrianus J. Dekker.*** 208 pp. 1959. Prentice-Hall, Inc., Englewood Cliffs, N. J. (TK453 D36e)

393* The Motor Drive, the Main Element in a Continuous Rolling Mill System. The rigidity of the mechanical characteristics of the motor drive stands of a continuous mill has a definite effect on the trend of the technical process, whose qualitative indices can be modified by a change in such rigidity. *(In Russian.)* Elektroprivod kak osnovnoĭ element v sisteme nepreryvnogo prokatnogo stana. ***N. N. Druzhinin.*** *Elektrichestvo*, 1959, no. 9, Sept., p. 35-40.

394* Underlying Principles of the Electric Signal Theory. A scheme for the classification of the characteristics of electric signals is given where there is room for new concepts of entropy and correlation, and which offers a survey of the existing relationships in the form of functional transformations or mean values in time, spectrum and statistic representation. *(In German.)* Über Grundlagen der Theorie elektrischer Signale. ***F. H. Lange.*** *Hochfrequenztechnik und Elektroakustik*, v. 68, no. 1, May 1959, p. 25-35.

395* Modern Ferromagnetic Materials. A brief account of developments concerning Si-Fe, Ni-Fe, and permanent-magnet alloys. Ferrites and ferrimagnetism are also discussed. ***F. Brailsford.*** *Institution of Electrical Engineers, Journal*, v. 5, no. 56, Aug. 1959, p. 417-424.

396* Electrical Materials and Components for Aircraft Power Equipment Operating at High Temperatures. Describes the materials now available and in course of development which are suitable for use in components for operation at high ambient temperatures. Describes present and future developments of components for aircraft electrical power distribution. ***D. B. McKenzie.*** *Institution of Electrical Engineers, Proceedings*, v. 106, pt. A, no. 28, Aug. 1959, p. 321-325.

397 Dielectric Measurements on Thin Films by Means of Electrodes Coated With Irradiated Silicone Rubber. Discusses difficulties in measuring the dielectric properties of thin films by conventional methods. Describes an alternative method of measurement and an electrode assembly with which the technique was proved. ***W. P. Baker and F. B. Waddington.*** *Journal of Scientific Instruments*, v. 36, July 1959, p. 309-312.

398 Impedance Transformations Through Lossless Two-Ports Represented by Fractional Linear Transformations of the Unit Circle. Any impedance transformation by a lossless two-port network corresponds to an automorphism of the unit circle in the complex reflection-coefficient plane. Such a mapping of the unit circle, determined by three parameters, can always be decomposed into three successive elementary transformations: a rotation about the origin, a hyperbolic transformation corresponding to the impedance transformation by an ideal transformer, and a further rotation about the origin. This decomposition leads to a simple graphical method for the determination of the transformed impedance and for the treatment of cascades of lossless two-ports. ***K. Jost.*** *Philips Research Reports*, v. 14, no. 4, Aug. 1959, p. 301-326.

399 Interim Report on Investigation of Dynamic Characteristics of Relays. Armature overtravel in relays; armature closure time as influenced by spring tension and air gap; comparison of activation time for NO and NC contacts. *U. S. Atomic Energy Commission*, SC-4336, Aug. 1959, 48 pp. (UF767 Un3.1sc Contin.)

400* Ionizing Characteristics of Paper-Oil-Filled Insulation Capacitor for High-Voltage Equipment. The ionization stability of paper-oil insulation is secured when the working intensity is lower than the intensity of the unstable ionization and when the testing intensity is lower than the intensity of the stable ionization. For insulation without fans of the ends of the plates with a 1 mm layer thickness, the ionization processes are determined by the processes in the margin of the electrode. The intensity during the testing voltage and the overvoltages must not exceed 12 kv/mm and, during the working votlage, 3.6 kv/mm. *(In Russian.)* Ionizatsionnye kharakteristiki bumazhno-maslianoĭ kondensatornoĭ izoliatsii dlia vysokovol'tnoĭ apparatury. ***G. S. Kuchinskii, O. V. Tikhanova, and G. T. Messerman.*** *Vestnik Elektro-Promshlennosti*, v. 30, no. 9, Sept. 1959, p. 37-42.

See also: **567** (thermopile generators); **638** (tungsten electric lamp filaments); **1045** (potting resins for electrical components); **1047** (epoxides in slip ring and commutator assemblies); **1051** (silicone dielectrics); **1093** (irradiated polyethylene in wire and cable); **1112** (mechanical and electrical properties of synthetic rubbers for cables).

ELECTROCHEMISTRY

401* Electropolishing Techniques for Metals and Alloys. Reviews briefly the history of electropolishing and describes the practical techniques used. ***S. Gruettner.*** *Industrial Finishing (London)*, v. 11, Aug. 1959, p. 49 + 2 pages.

402 Anodised Aluminium Mirrors. A procedure based on anodizing, stripping, and re-anodizing gave a better mirror surface on super-pure Al than one involving electropolishing. Diamond abrasive was used for lapping prior to this treatment. The surface quality of the mirrors was satisfactory, but fell short of perfection, largely because of a persistent fine ripple in the surface. ***J. J. Dale, L. H. Esmore, and I. J. Howell.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 4, Summer 1959, p. 128-134.

403* Anodizing and Plating Aluminum. Includes pretreatment, electrolytes, coating characteristics, operating conditions, racks, coloring, sealing, hard coating, built-in colors, electroplating, plating metals, and electropolishing processes. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 80 + 6 pages.

404 Progress Toward the Development of a Nonembrittling Cadmium Electroplating Process. III. The Use of Triethanolamine in Cadmium Plating Solutions. Noncyanide aqueous baths containing triethanolamine or triethanolamine plus glycine were investigated over a wide range of composition and pH for their characteristics in plating Cd on ultrahigh-strength steel. Plating evaluation included current-density characteristics, embrittlement characteristics, and barrel-plating characteristics including bath life in continuous plating. ***P. N. Vlannes, S. W. Strauss, and B. F. Brown.*** *Plating*, v. 46, Oct. 1959, p. 1153-1157.

405 Filtration of Electroplating Solutions. The types of pressure filters most often found in the filtration of electroplating solutions are presented. A brief discussion of the advantages and operating characteristics of each type is included. In

addition, a discussion of the general conditions of pressure filtration with the emphasis on practical steps necessary to improve filter performance is undertaken. Tables are included showing flow rates for various plating baths and describing the filter types covered. ***Rockwell M. Gray, Jr.*** *Plating*, v. 46, Oct. 1959, p. 1165-1170.

406 Evaluation of Protective Coatings for Molybdenum Nozzle Guide Vanes. Thirty-seven Mo nozzle guide vanes coated by various organizations for resistance to jet engine operating conditions were evaluated in an engine exhaust stream at 1860-1890 F for four hours. Results indicate that in the temperature range of the test, multilayer electrodeposited metallic coatings have the longest service life. ***John R. Giancola.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Note* 58-241, June 1959, 39 pp. (TL507 Un3.18: Contin.)

407* The Segregation of Chromium from Complex Chromium Sulfate Solutions. Under certain conditions of amperage, temperature and P_H value, it is possible for Cr to be segregated, in glossy form, from complex Cr tri-sulphate solutions containing urea, at a current utilization of 10 to 15 per cent. Such coatings can be used as a substitute for decorative Cr, though not for hard-Cr plating since it is not possible to obtain coatings of major thickness. *(In German.)* Über die Abscheidung des Chroms aus komplexen Chromisulfatlösungen. ***Willi Machu and M. F. M. El-Ghandour.*** *Werkstoffe und Korrosion*, v. 10, Sept. 1959, p. 556-563.

ELECTRONICS

408 Exotic Radio Communications. For sending a broadband radio signal across the Atlantic, earth-satellite reflectors or repeaters offer many intriguing possibilities. But even to determine whether such communication is feasible requires careful study, experimentation and measurement. ***J. R. Pierce.*** *Bell Laboratories Record*, v. 37, Sept. 1959, p. 323-329.

409 The Diffusion of Impurities Into Evaporating Silicon. ***R. L. Batdorf and F. M. Smits.*** *Bell Laboratories Record*, v. 37, Sept. 1959, p. 330-333.

410 Application of Telegraph Techniques in Data Transmission. Modernization and mechanization in business has brought drastic changes in methods and instrumentation to handle large volumes of data at high speeds. Telegraph techniques in principle apply to data transmission systems. ***A. Boggs and J. E. Boughtwood.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 336-340.

411 Effects of Operation of Germanium Alloy Junction Transistors Above Rated Conditions. The exploratory experiments used for two similar types of alloy junction transistors are described and the median parameter variations with time are presented in graphical form. ***B. C. Spradlin.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 346-352.

412 A Magnetic Amplifier Flow Controller. The design has the long life and dependability expected from an all-magnetic circuit and still meets the exacting accuracy and stability requirements of industrial process control. It is intended for fast response processes. ***H. E. Darling.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 373-379.

413* Radar-Bibliography. Radar Literature of the Last Five Years. A summary of competent titles of radar text-books as well as of reports and indications on radar of the last five years. ***W. Reinhardt.*** *Deutsche Versuchsanstalt für Luftfahrt, Berichte*, no. 73, June 1959, 103 pp.

414* Hybrid Junctions. A review of the existing theoretical analyses of hybrid junctions is presented to show how the phase difference between the waves from the two output arms varies with frequency. It is shown that this variation is very small in the case of all well-matched 90° hybrid junctions but, for the hybrid ring, a large variation in phase difference occurs due to asymmetry of the junction. Typical results for an X-band hybrid ring in the transmit condition show that the bandwidth to the points where the v.s.w.r. drops to 0·8 is 350 Mc/s with the extra quarter-wavelength in one arm, but is no less than 1,650 Mc/s with the extra quarter-wavelength in the other arm. ***R. Levy.*** *Electronic & Radio Engineer*, v. 36, Aug. 1959, p. 308-312.

415* Design of Transistorized DC-to-DC Converters. I. Ringing-Choke Circuit. A presentation of all necessary data and procedures required for the design of transistorized ringing-choke dc-to-dc converters. Typical values of magnetic parameters are tabulated and a step-by-step design example is covered. Also included is a section devoted to all necessary equations with their derivations. ***Carl R. Turner.*** *Electronic Design*, v. 7, no. 19, Sept. 16, 1959, p. 40 + 3 pages.

416* Zero-Crossing Detector Generates Pulses Every 180 Degrees. The circuit can be used as an encoder, a pulse generator, or a frequency doubler. ***John S. Denelsbeck.*** *Electronic Design*, v. 7, no. 19, Sept. 16, 1959, p. 48-51.

417 A Multi-Range, Low Frequency Band-Pass Filter. A frequency range from 16c/s to 175c/s is covered in nine bands, the ratio of the upper to the lower frequency of each pass-band being 1·38. The basis of the filter circuit is the frequency selective RC valve amplifier modified to give zero output at frequencies of 0 and ∞. With two such amplifiers in cascade, the response in the pass-band is flat within ±5%, and attenuation of the 3rd harmonic of the lower frequency limit is 33 times. The use of a special feedback network in the amplifiers enables a change of pass-band to be made by switching two capacitors in each network. ***J. B. Bratt.*** *Electronic Engineering*, v. 31, Aug. 1959, p. 458-462.

418 The Theory of Broadband Coupled Circuits. This article gives the exact transfer admittance formulas for various types of parallel-tuned coupled circuits. It is shown that with a certain degree of inductive coupling, a circuit results which not only has good phase response but also has a response curve showing a remarkable degree of symmetry with frequency deviation. ***W. Dougharty.*** *Electronic Engineering*, v. 31, Aug. 1959, p. 488-494.

419* How to Design Inductors for Electronic Equipment. The design of inductors usually involves a considerable amount of guesswork. To eliminate this, a simple relationship between the parameters of an inductor is derived. This relationship is then used to develop a speedy method of core evaluation. ***R. G. Luebben.*** *Electronic Equipment Engineering*, v. 7, Sept. 1959, p. 40-44.

420* Evaluating Encapsulating Materials. A procedure for evaluating many important properties of encapsulants with minimum equipment is suggested. ***D. F. Christensen.*** *Electronic Equipment Engineering*, v. 7, Sept. 1959, p. 51-53.

421 Infrared Communications Receiver for Space Vehicles. Circuit diagram for an experimental receiver is included. Circuits reject solar infrared noise. ***W. E. Osborne.*** *Electronics*, v. 32, no. 38, Sept. 18, 1959, p. 38-39.

422 High Magnetic Fields for Advanced Research. A survey discussing the evolution of the art, its future development, and the part it plays in research work. ***Henry H. Kolm.*** *Electronics*, v. 32, no. 40, Oct. 2, 1959, p. 43-47.

423 Modern Communications Methods. Problems of modern communications propagation, over-the-horizon systems, exotic systems, modulation, transmission and information theory are discussed. ***Samuel Weber.*** *Electronics*, v. 32, no. 43, Oct. 23, 1959, p. 93-108.

424* A Contribution to the Analysis of an Oscillator Circuit on Semiconductor Triodes. A study was made of the problem of the accuracy and limit of applicability of a method of analysis of an oscillator circuit on semiconductor triodes, based on the examination of the coefficient of amplification under open condition of the back coupling. A general method was given for the case of an uninterrupted feedback. *(In Russian.)* K analizu skhem avtogeneratorov na poluprovodnikovykh triodakh. ***A. I. Aleksandrov and E. N. Garmash.*** *Elektrosviaz'*, v. 13, no. 8, Aug. 1959, p. 31-37.

425* Effects of the Diversity of the Tube Parameters on the Pulse Duration in Multivibrator Circuits. *(In Russian.)* Vliianie razbrosa parametrov lamp na dlitel'nost' impul'sa

v skhemakh mul'tivibratorov. ***V. B. Silin.*** *Elektrosviaz'*, v. 13, no. 8, Aug. 1959, p. 43-51.

426* Infrared, a New Frontier of Physics and Technology. A comprehensive review of the infrared field, prepared under the auspices of the Infrared Information Symposia (IRIS). *I. R. E. Proceedings*, v. 47, Sept. 1959, p. 1415-1649.

427 A Variational Expression for the Terminal Admittance of a Semi-Infinite Dielectric Rod. The reflection produced on the $TM_{0,1}$ surface wave is determined by calculating the terminal admittance of the surface wave at the end of the rod. The complete sets of proper and improper eigenfunctions are found for both waveguides and used to represent the transversal fields. Finally, a variational expression is set up for the admittance and an approximate value is obtained using as trial field the pure $TM_{0,1}$ surface wave. ***C. M. Angulo and W. S. C. Chang.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 207-212. (TK1 In6.6ap Vis.)

428 Radiation From Slot Arrays on Cones. A method is obtained for determining far field patterns, sidelobes as well as the main beam, for an array of slots on the surface of a cone. It is found that accurate results can be obtained for a single slot by using geometric optics for the main beam and an extension of Fock theory for fields in the shadow region. A radiation pattern from a linear array of 65 slots on the surface of a cone was computed and compared with experiment. The agreement is excellent. The maior theoretical part of this paper is the generalization and simplification of Fock theory as applied to the surface of a cone. ***R. F. Goodrich, et al.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 213-222. (TK1 In6.6ap Vis.)

429 A Study of Spherical Reflectors as Wide-Angle Scanning Antennas. In order to keep the effects of spherical aberration within tolerable limits, the approach of using a restricted aperture is adopted. Experimental results show that the phase error over the illuminated aperture of a spherical reflector should not exceed one-sixteenth of a wavelength. This requirement determines the beamwidth of the primary source. A square-aperture horn with diagonal polarization is found to satisfy the requirements of a suitable feed for the reflector. ***Tingye Li.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 223-226. (TK1 In6.6ap Vis.)

430 Analysis and Reduction of Scattering From the Feed of a Cheese Antenna. The far field of a cheese antenna can be described in terms of three components: (a) one due to the unobstructed aperture field, (b) one due to that portion of the primary feed energy not intercepted by the reflector, and (c) a scattered component due to the fact that the feed acts as an obstacle in the path of energy emerging from the reflector. An antenna is described in which the scattered field and the backlobe of the primary feed are made to partially cancel. An additional control over these field components is provided by a series of vanes or waveguides located on either side of the feed. ***W. A. Cumming, C. P. Wang, and S. C. Loh.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 226-233. (TK1 In6.6ap Vis.)

431 On the Phase Velocity of Wave Propagation Along an Infinite Yagi Structure. An approximate expression is derived and its dependence on the various parameters of the structure is discussed in detail. It is assumed that a traveling wave is propagating along the axial direction and it induces an axially symmetric and sinusoidal current distribution in each element. The electric field at any point due to this current distribution is calculated by the Hertz vector method. After applying boundary condition to the electric field, an expression for the propagation constant is derived. Results are compared with existing experimental values. Agreement between theory and experiment is found to be within 5%. ***Dipak L. Sengupta.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 234-239. (TK1 In6.6ap Vis.)

432 Effect of Relatively Strong Fields on the Propagation of EM Waves Through a Hypersonically Produced Plasma. The exact theory of conductivity developed by Margenau is for impressed, relatively high field strengths too difficult to handle from an analysis and computational standpoint. By making two simplifying assumptions in the general velocity distribution function and graphically interpolating between them, two relations, one nearly exact and one employing the simple theory, are obtained for the conductivity. The accuracy of these relations is then examined analytically for a typical case, and graphical comparisons between the methods are made. ***W. B. Sisco and J. M. Fiskin.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 240-244. (TK1 In6.6ap Vis.)

433 Microwave Scattering by Turbulent Air. Describes a system for measuring the power scattered by a region of thermally turbulent air and analyzes its performance. Also describes equipment used to generate the turbulent region and temperature fluctuations therein. The experimental procedure consisted in measuring the fluctuations of the null in the interference pattern of an antenna array composed of two antennas excited out of phase, when thermally turbulent air, of known properties, was interposed between the receiving and transmitting systems. The experiment described shows that a measurement of the angular dependence of the signal scattered by turbulent air is within the possibilities of available techniques, although a more elaborate measuring system and higher microwave power levels would be required. ***Charles E. Phillips.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 245-251. (TK1 In6.6ap Vis.)

434 Influence of an Atmospheric Duct on Microwave Fading. Presents results of continuous observation of a duct utilizing a tower 312 meters high, together with those of measurements of microwave fading conducted simultaneously. A ray-theoretical analysis is given, indicating that fading may be attributed to the divergence or the convergence of radio waves and to the interference of two or more rays, caused by existence of a duct, or, more generally, of nonlinear M-profile. ***F. Ikegami.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 252-257. (TK1 In6.6ap Vis.)

435 Comparison of Computed With Observed Atmospheric Refraction. Concludes that within the limits of this experiment: (a) ray-tracing methods are justified, (b) horizontal stratification may be assumed, and (c) the accuracy of bending predictions is increased by improving the meteorological data. ***W. L. Anderson, N. J. Beyers, and B. M. Fannin.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 258-260. (TK1 In6.6ap Vis.)

436 Diffraction Theory of Tropospheric Propagation Near and Beyond the Radio Horizon. I. Theory. It is found that the classical diffraction theory is as valid at ranges beyond the horizon as in its neighborhood, if account is taken of the contribution of other terms than the first of the residue series, and that exclusive use of the saddle point method makes it possible to deal systematically with the tropospheric propagation for all regions within, near, and beyond the horizon. ***O. Tukizi.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 261-267. (TK1 In6.6ap Vis.)

437 Diffraction Theory of Tropospheric Propagation Near and Beyond the Radio Horizon. II. Comparison With Experiments. A comparison of theory with experiments showed fairly good agreement. ***O. Tukizi.*** *IRE Transactions on Antennas and Propagation*, v. AP-7, no. 3, July 1959, p. 268-273. (TK1 In6.6ap Vis.)

438 Factors Affecting Modulation Techniques for VHF Scatter Systems. An experimental program at approximately 50 mc was carried out over a 1295-km east-west ionospheric-scatter path to determine the communication capacity of the propagation medium using ordinary modulation techniques. Studies of intelligibility for voice transmission were made using narrow-band frequency modulation and single-sideband modulation. Using 20-kw power, the frequency-modulation tests with dual-diversity receivers and narrow-beam rhombic antennas gave good results at levels of signal-to-noise ratio exceeded for 90% of the year at 50 mc. ***J. W. Koch.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 2, June 1959, p. 77-92.

439 Synchronization of Single-Sideband Carrier Systems for High-Speed Data Transmission. Discusses requirements for synchronization of single-sideband carrier systems, methods of accomplishing absolute synchronization, problems of application to existing systems, and alternative solutions. ***Thomas Combellick.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 2, June 1959, p. 110-114.

440 Propagation of HF and VHF in the Arctic Region. All the available ionospheric records for stations located north of 60° geographic latitude and for the period 1954 to 1957 were critically analyzed. The F2 region shows two distinct types: one, north of 75° with very little or no diurnal and seasonal variation in the critical frequency; the second, south of 70°N, exhibits diurnal and seasonal variations as well as those correlated with sunspot activity. Three types of sporadic E abnormalities were found; namely, the Thule type, the Auroral-Belt type, and the Mixed type. ***R. Penndorf and S. C. Coroniti.*** *IRE Transactions on Communications Systems*, v. CS-7, no. 2, June 1959, p. 121-125.

441 Some Effects of Fast Neutron Irradiation on Carrier Lifetimes in Silicon. Single crystal specimens of silicon have been exposed to fast neutrons from a reactor source to determine the room temperature effects of irradiation on carrier lifetimes. For highly *n* and *p*-type material the approximate lifetime damage constants, defined as $1/\tau = 1\tau_i + \alpha\phi$, are found to be $\alpha_n = 4.4 \times 10^{-7}(\text{nvt})\text{-}1_x(\text{sec})^{-1}$ and $\alpha_p = 1.2 \times 10^{-6}(\text{nvt})^{-1}(\text{sec})^{-1}$. Two possible positions of the dominant recombination level are 0.36 ev below the conduction band or 0.33 ev above the valence band. Further agreement with the value of α_p has been obtained by measuring high level lifetime in silicon junction diodes. ***R. W. Beck, E. Paskell, and C. S. Peet.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1437-1439.

442 Methods of Experimental Physics. v. VI. Pt. B. Solid State Physics. Covers electrical properties, galvanomagnetic and thermomagnetic effects, magnetic properties, optical properties, luminescence, and photoelectric phenomena. ***K. Lark-Horovitz and Vivian A. Johnson, editors.*** 416 pp. 1959. Academic Press, New York. (QC41 M56)

443* High Power X-Band Backward-Wave Oscillator. A discussion of the QK634 X-band tube, including electron gun and magnet design, operation, and characteristics. ***Roy Paananen.*** *Microwave Journal*, v. 2, Sept. 1959, p. 27-30.

444* Broad Band, Multi-Port Waveguide Switches. The first switch is a high speed, single pole-five throw device which is used to switch the magnetron line to each of five separate reflector-feed assemblies sequentially on a pulse-to-pulse basis. This sequential lobing antenna system operates at a pulse recurrence rate of 1200 pulses per second, so that the switch must execute 1200 switchings per second. The second switch is a low speed, single pole-six throw device which is used to switch the magnetron line between six individual antennas arranged equally spaced around a circle. One antenna is electrically connected to the transmitter for 52 degrees of mount rotation, then blanked out for 8 degrees (dead time). The next antenna is then connected to the transmitter for 52 degrees azimuth rotation, etc. In this way, six scans per second are achieved. Both switches operate over 8500-9600 mc/s. band at 250 KW peak pulse power. ***Harry C. Berland and Fred W. Vortmeir.*** *Microwave Journal*, v. 2, Sept. 1959, p. 30-37.

445* A Novel Aid to Slotted Line Measurements. Describes a "slotted line attachment" which provides the direct reading of wavelength shift with respect to a selected reference point. This data can thus be entered immediately on a Smith Chart. Extensive laboratory use of this device has demonstrated its accuracy as well as its time-saving qualities. ***Bernard Lamberty.*** *Microwave Journal*, v. 2, Sept. 1959, p. 38-42.

446* Surface Problems in Barrier Layer Semiconductors. The concentration of the charge carriers directly under the surface of a Ge crystal depends on the composition of the surrounding gas phase. This can cause the formation of an inversion layer which is felt in the case of a pn junction owing to the formation of a channel and to the ensuing increase of the inverse current. Failures in transistor fabrication were eliminated by the introduction of air-conditioning conditions. (*In German.*) Oberflächenprobleme an Sperrschichthalbleitern. ***H. H. Plagemann.*** *Nachrichtentechnik*, v. 9, no. 7, July 1959, p. 292-295.

447* Noise of Deposited Carbon Resistors. Dispersions were given for the background noise of certain resistance groups, based on the geometrical measurements and on a specific noise capacity of the layer material. The higher the resistance, the more precisely stable the geometrical dimensions of a resistance band. This causes a limitation of the noise amplitude for these resistance values. (*In German.*) Rauschen von Kohleschichtwiderständen. ***K. Biebach.*** *Nachrichtentechnik*, v. 9, no. 7, July 1959, p. 310-313.

448* Parametrical Amplifiers. A study concerning step-down converters in which the signal is directly amplified. In the step-up converters the amplified signal is transformed into a higher frequency. The principle of the parametric amplification with varying capacity was explained by means of a single resonance circuit. (*In German.*) Parametrische Verstärker. ***R. Krönert.*** *Nachrichtentechnik*, v. 9, no. 7, July 1959, p. 328-333.

449 Noise in Electron Beams and in Four-Terminal Networks. It is shown that the calculation of the minimum noise figure of electron-beam amplifiers, obtainable by varying the physical properties of the lossless beam transducer between the electron gun and the interaction region, can be performed in a manner which is similar to the calculation of the minimum noise figure of network fourpoles obtainable by varying the signal-source impedance. Further, the similarity between the propagation of noise fluctuations along electron beams and the transformation of noise sources across passive fourpoles is emphasized. ***M. T. Vlaardingerbroek.*** *Philips Research Reports*, v. 14, no. 4, Aug. 1959, p. 327-336.

450 Rate of Diffusion-Limited Annihilation of Excess Vacancies. The rate of removal and spatial distribution of excess vacancies are calculated for the case where the transport to vacancy sinks takes place by diffusion and where dislocations in the volume of the sample, the surface of the sample, or both may act as sinks. It is found that in the case where the dislocations are the only sinks, the decay in average concentration is exponential. The decay time constant is almost inversely proportional to the dislocation density. In a bar of square cross-section the contribution of the two types of sink is about equal if a few tens of dislocations emerge through the smallest cross-section. ***P. Penning.*** *Philips Research Reports*, v. 14, no. 4, Aug. 1959, p. 337-345.

451 Surface Recombination of Silicon. The surface recombination velocity of electrons and holes in Si is investigated by measuring the photovoltaic effect of a *p-n*-junction alloyed on a thin Si wafer. It appears that after treating the surface with an aqueous solution of potassium dichromate the recombination is lowered by ozone in the ambient atmosphere, and raised by moisture. The opposite behavior is observed after etching with hydrofluoric acid. In principle, there is no difference in the behavior of *n*-type and *p*-type Si. In many cases the surface recombination can be decreased with light, particularly if the surface treatment tends to form an inversion layer. ***H. U. Harten.*** *Philips Research Reports*, v. 14, no. 4, Aug. 1959, p. 346-360.

452 Phase Equilibria and Semiconducting Properties of Cadmium Telluride. The relation is studied between the electrical and optical properties of single crystals of cadmium telluride and the conditions of preparation. From optical transmission measurements at various temperatures, a value for the band gap of 1·50 eV at room temperature and a temperature dependence of $2 \cdot 34.10^{-4}$ to $5 \cdot 44.10^{-4}$ eV/°K is found. Peaks in the spectra of photoluminescence and photoconductivity can be correlated with a band-band transition and with transitions between levels, caused by known centers, and one of the bands. ***D. de Nobel.*** *Philips Research Reports*, v. 14, no. 4, Aug. 1959, p. 361-399.

453* Effect of Intermediate Electrodes on Ignition Voltage of a Self-Discharge in a High-Voltage Metal Mercury Rectifier. In a sectionalized high-voltage rectifier at a pressure higher than normal working pressure, the presence of intermediate electrodes—inserts between the grid and the anode of the tvpe investigated, twice decreases the distance between the electrodes. This distance is necessary for the development of the glow discharge. The ignition voltage increases correspondingly. (*In Russian.*) Vliianie promezhutochnykh elektrodov na napriazhenie zazhiganiia samostoiatel'nogo razriada v vysokovol'tnom metallicheskom rtutnom ventile. ***S. V. Ptitsyn, D. D. Aleksandrov, and N. F. Olendzkaia.*** *Radiotekhnika i Elektronika*, v. 4, no. 8, Aug. 1959, p. 1278-1283.

454 Protection of Communications and Electronic Systems. Considers meeting wartime threats to communications and electronic systems by the use of many different types of

independently vulnerable communications systems. ***F. R. Eldridge.*** *Rand Corporation, Report P-1657,* Apr. 13, 1959, 11 pp. (T13 R15r Contin.)

455* Technology of the Alloyed Transistor. The physical and chemical problems encountered in alloying transistors are here discussed with the *p-n-p* Ge transistor taken as an example. Favorable electrical characteristics depend on planar and parallel *p-n* junctions. Such junctions may be realized with the aid of certain flux agents and by utilizing the crystal lattice characteristics of Ge. (*In German.*) Zur Technologie des legierten Transistors. ***Dieter Enderlein.*** *Siemens Zeitschrift,* v. 33, no. 8, Aug. 1959, p. 493-499.

456 Signal to Noise Improvement Through Coding. Discusses the practical limitations of the simple model. An example illustrates the conclusions to be drawn through this type of analysis. ***John C. Mott-Smith.*** *U. S. Air Force, Cambridge Research Center, AFCRC-TR-59-143,* May 1959, 17 pp. (TK7800 Un3.12b Contin.)

457 An Analogue System for Computing Correlation Coefficients. A system has been devised and constructed to measure the correlation coefficient between data pairs recorded on film; it is used to transcribe the data manually from film to magnetic tape. An electronic correlator operates on the magnetic tape output. The original data may be in wave train form, 0 to 50 cycles in length, and means is provided to adjust the time delay between the data pairs. ***J. M. Headrick and J. L. Ahearn, Jr.*** *U. S. Office of Naval Research. NRL Report* 4835, Sept. 24, 1956, 7 pp. (T21 Un3.5n Contin.)

458* Vestigial Sideband Transmission as Proposed for Intercity Facsimile Signals. ***Edgar S. Grimes.*** *Western Union Technical Review,* v. 13, no. 4, Oct. 1959, p. 152-158.

459* Magnetic Tape Heads. Erase, record, and replay heads with a discussion of factors influencing their design and construction. ***C. Ross.*** *Wireless World,* v. 65, July-Aug. 1959, p. 321-326.

460* Ferroelectrics. II. Domains: And Some Applications of Ceramics. Materials, domains, wall movements, domain structures, ceramics, applications, transducers, and capacitors. ***J. C. Burfoot.*** *Wireless World,* v. 65, July-Aug. 1959, p. 326-332.

461* The Measurement of the Intensity of X-Ray Diffraction Reflections With a Ga As-Barrier Layer. The application of a Ga As-barrier layer for the registration of monocrystal reflections and of reflection diagrams of powder samples is discussed. (*In German.*) Messung der Intensität von Röntgenbeugungsreflexen mit Hilfe eines GaAs-Sperrschichtelements. ***Hans Pfister.*** *Zeitschrift für Angewandte Physik,* v. 11, no. 8, Aug. 1959, p. 290-296.

462* On the Conduction Mechanism of Oxide Semiconductors at High Temperatures. The conductivity of oxide semiconductors in O was determined at high temperatures and with not too high impurity center concentration, not only by means of the thermal separation of carriers from these centers, but also in a definite proportion by means of a change of the impurity center concentration depending on the temperature and the O pressure as a result of a reaction with the surrounding atmosphere. (*In German.*) Über den Leitungsmechanismus oxydischer Halbleiter bei hohen Temperaturen. ***J. Rudolph.*** *Zeitschrift für Naturforschung,* v. 14a, no. 8, Aug. 1959, p. 727-737.

***See also*: 934** (advances in electronics and electron physics).

ENGINEERING ECONOMICS

463 More Office Space Through Planning. Describes the "overlay" technique which can aid in the above task. ***John R. Walley.*** *American Business,* v. 29, Oct. 1959, p. 26-27.

464* Some Methodological Notes on the Deflation of Construction. Proposes a re-definition of output in terms of intermediate products; and two indirect methods for obtaining a measure of the change in the average price of intermediate products. ***Norman M. Kaplan.*** *American Statistical Association, Journal,* v. 54, no. 287, Sept. 1959, p. 535-555.

465* A Note on the Relationship Between Earning Expectations and New Car Purchases. Surprisingly, in a sample of American spending units those expecting to make less, actually turned out to be the more frequent purchasers. ***Peter E. de Janosi.*** *American Statistical Association, Journal,* v. 54, no. 287, Sept. 1959, p. 575-577.

466 Electric Melting Economics. ***J. G. Coutant.*** *Blast Furnace and Steel Plant,* v. 47, Oct. 1959, p. 1073-1078.

467* Doing Business in the Common Market. In relation to available business opportunities, let alone growth prospects, U. S. investment in EEC is still very slight. ***Emile Benoit.*** *Business Horizons,* v. 2, no. 1, Spring 1959, p. 30-37.

468 The Brokers Who Deal in Ideas. Inventions find their way to market through the help of the new products scouts. Now, with manufacturers clamoring for new ideas to increase sales, they sign up research labs and proved inventors. *Business Week,* no. 1569, Sept. 26, 1959, p. 99 + 2 pages.

469 Structure of a Pharmaceutical Firm. ***George W. Orr, Jr.*** *Drug and Cosmetic Industry,* v. 85, no. 3, Sept. 1959, p. 308 + 5 pages.

470 Detroit's Next Decade. The password around Detroit is "functional". For the first time since the 1920's the auto industry is really going to offer a car "for every purse and purpose". It is good news for consumers—and for the whole U. S. economy. ***Gilbert Burck and Sanford S. Parker.*** *Fortune,* v. 60, no. 4, Oct. 1959, p. 112 + 5 pages.

471 The War of the Computers. Computer builders are gambling half a billion dollars on the belief that even small companies can profit from E.D.P. ***Francis Bello.*** *Fortune,* v. 60, no. 4, Oct. 1959, p. 128 + 9 pages.

472 Use Data Processing to Direct Your Marketing Operation. A data processing system can tell you what is happening to your sales and profit dollars. It pinpoints both strength and weakness in your salesmen, your areas, and your projects. *Iron Age,* v. 184, no. 12, Sept. 17, 1959, p. 77-79.

473 How Operating With Automation Affects All Company Functions. Functions other than direct manufacturing must change when a company moves to automation. The move demands tighter control of sales, purchasing, designing, and equipment buying. ***G. J. McManus.*** *Iron Age,* v. 184, no. 12, Sept. 17, 1959, p. 103-105.

474 What Makes a Good Plant Site? Rockwell Manufacturing has experienced an extensive expansion and relocation program. Before making its choice, the company studies all sides of the question. ***G. J. McManus.*** *Iron Age,* v. 184, no. 14, Oct. 1, 1959, p. 42-43.

475* Work Smarter—Not Harder. Discusses work simplification and employee participation in methods improvements. ***Jack R. Irish.*** *Modern Castings,* v. 36, Sept. 1959, p. 36-40.

476 The Plasticizer Market in Review. Plasticizer consumption is estimated to have been 445 million lb. in 1958, a slight increase over 1957 demand. Production and sales statistics are given. ***William J. Reid.*** *Modern Plastics,* v. 37, no. 2, Oct. 1959, p. 174 + 4 pages.

477 Weigh Your Paperwork. To measure and combat waste in paperwork at Sinclair Pipe Line Company a Paperwork Simplification program was initiated. The program is now conducted by company personnel, and the training of Sinclair people will continue on a voluntary basis until all who are interested have had an opportunity to study the subject. ***F. X. Wernett and L. E. Salisbury.*** *Petroleum Engineer,* v. 31, Sept. 1959, p. E1-E4.

478 13 Ways to Cut Drafting Costs. A listing of modern methods and materials compiled by an expert in drafting-room procedures. ***A. F. Gagne.*** *Product Engineering,* v. 30, no. 40, Sept. 28, 1959, p. 54-56.

479* Where Does the Pulp and Paper Industry Stand in the General Economy of the Peoples Democracies? Soviet Union, Communist China, Poland, East Germany, Czechoslovakia, Hungary, Bulgaria, Rumania, Yugoslavia. This article is translated from the original three-part series under the title "Economie Générale et Economie Papetière des Democraties Populairs", by M. Maurice Pariat, which appeared in *La Papeterie* (March, April and May 1959 issues). Within the group of communist nations, the U.S.S.R. has been the predominant factor until now. The arrival in the picture of China changes the present outlook. China's economic potential is enormous: population, raw materials, dictatorial government —the advent of this super-nation playing a leading role, can only hinder Russian dominance. Pulp and paper requirements in these countries will remain, for many decades, greater than domestic production. The Peoples Democracies are forced to purchase on the markets of the world—it would be a mistake to ignore them. ***Maurice Pariat.*** *Pulp and Paper Magazine of Canada*, v. 60, Sept. 1959, p. 100-111.

480 Raw Materials. A Study of American Policy. Objectives are to examine the more important measures of United States policy which affect the supply of materials of American industries and to suggest changes in national policies which will make them better adapted to the technological advances and changes in international relations which may be expected in the immediate future. ***Percy W. Bidwell.*** 403 pp. 1958. Harper & Brothers, New York. (HF1051 B47r)

481* Many Elements Fix Products Reliability. ***Gordon S. Mead.*** *SAE Journal*, v. 67, Oct. 1959, p. 46-47.

482 Productivity: Consider the 'Other 40%'. Considers the 40% of the sales dollar which goes for organization and policy matters, and describes methods to increase efficiency in handling paperwork. *Steel*, v. 145, Oct. 5, 1959, p. 50-52.

See also: **512** (Canadian mineral industry, 1955).

FLUID MECHANICS

483 Some Aspects of Fluid Mechanics in Chemical Engineering. More elemental relationships pertaining to thermal and material transfer in flowing streams are considered, and some of the interrelations of the transport processes are presented. ***B. H. Sage.*** *A.I.Ch.E. Journal*, v. 5, no. 3, Sept. 1959, p. 331-338.

484 Fluid Dynamics and Diffusion Calculations for Laminar Liquid Jets. ***L. E. Scriven and R. L. Pigford.*** *A.I.Ch.E. Journal*, v. 5, no. 3, Sept. 1959, p. 397-402.

485* The Degree of Mixing in Continuous Flow Systems. The concepts of Danckwerts about the degrees of mixing and segregation are extended to the case of a continuous flow system with an arbitrary but known residence time distribution. ***Th. N. Zwietering.*** *Chemical Engineering Science*, v. 11, no. 1, Aug. 1959, p. 1-15.

486 Flow Measurement and Control. The objective of preparing this book is to collect representative information on the practical measurement and control of flow as a primary consideration. It is not written as a theoretical treatise on the subject but to provide information to the young chemical engineer as an introduction to the industrial applications of flow measurement. ***W. F. Coxon.*** 312 pp. 1959. Heywood & Company, London. (TP156.F6 C83f)

487 Fluidization. Presents all the major developments of a fundamental nature pertaining to fluidization, which have originated since fluidization emerged about 15 years ago. Collects descriptions of phenomena, experimental data, and working formulas that can be applied in many fields. ***Max Leva.*** 327 pp. 1959. McGraw-Hill, New York. (TP156.F65 L57f)

488* Liquid-Vapor Equilibrium in Nitrogen-Helium and Helium-Methane Systems. At pressures of from 40 to 215 atm. the solubility of He in liquid N and CH can be calculated with sufficient accuracy from the Krichevsky-Kazarnovsky equation. The constants of this equation are found for all temperatures investigated. The volatility of pure He is calculated in the temperature range from 6 to 160 K at pressures of 300 atm. (*In Russian.*) Ravnovesie zhidkost' par sistemakh azot-gelii i gelii-metan. ***F. F. Kharakhorin.*** *Inzhenerno-Fizicheskii Zhurnal*, v. 2, no. 9, Sept. 1959, p. 24-29.

489 Free Energy of a Nonuniform System. III. Nucleation in a Two-Component Incompressible Fluid. ***John W. Cahn and John E. Hilliard.*** *Journal of Chemical Physics*, v. 31, Sept. 1959, p. 688-699.

490* Transport Theory of Particle Clouds Moving With a Fluid Flow and Undergoing Property Changes. I. ***Kazuyoshi Fukusawa.*** *Journal of Mechanical Laboratory of Japan*, v. 5, no. 1, 1959, p. 1-12.

491 Turbulence. An introduction to mechanism and theory. ***J. O. Hinze.*** 586 pp. 1959. McGraw-Hill, New York. (QA901 H59t)

See also: **80** (heat transfer survey).

FOOD TECHNOLOGY

492* More Effective, Less Noticeable Food Preservatives. Methyl and propyl esters of p-hydroxybenzoic acid, recently approved by FDA, are effective against molds, yeast and bacteria in acid, neutral and alkaline pH ranges. Bactericidal and fungicidal killing rates are obtainable. *Food Processing*, v. 20, Sept. 1959, p. 65 + 9 pages.

493 Effects of γ-Radiation on the Taste and Manufacturing Properties of Soft Wheat. The effects of three dose levels of γ-radiation (125, 250, and 500 x 10^3 rads) on the physical, biochemical, and baking properties of English wheat. The slight changes induced by irradiation are considered of little commercial significance. ***P. B. Cornwell.*** *Journal of the Science of Food and Agriculture*, v. 10, Aug. 1959, p. 409-412.

494 Use of Lecithin in Production of Bread Containing Defatted Soya-Flour as a Protein Supplement. Loaf volume and bread-baking quality can be maintained in bread baked from different types of flour extraction and wheat strength mixed with defatted soya-flour and prepared without addition of sugar and fat, by increasing the level of oxidizing agent to the optimum and adding lecithin to the dough. ***L. Adler and Y. Pomeranz.*** *Journal of the Science of Food and Agriculture*, v. 10, Aug. 1959, p. 449-456.

495 Radiation Preservation of Food. ***S. D. Bailey, et al.*** *U. S. Office of Technical Services, PB* 151493, Aug. 1, 1957, 461 pp. (T21 Un3r Contin.)

FUELS AND COMBUSTION

496* The Propagation of a Turbulent Flame in Single-Phase and Double-Phase Combustion Systems. In a preliminary test with air mixed single-phase combustion system the concentration of O remains practically constant. The increase of the temperature of a double-phase medium of flame, moving to the front, is carried out by the heat transfer by rays from the front of the flame to the fuel particles. *(In Russian.)* O rasprostranenii turbulentnogo plameni v odnofaznykh i dvukhfaznykh goriuchikh sistemakh. ***E. A. Borovchenko.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 3, Mar. 1959, p. 100-102.

497* Fuel Improvement. The purpose of additives in modern fuels for spark ignition engines. ***C. G. Tresidder.*** *Automobile Engineer*, v. 49, Aug. 1959, p. 296-298.

498 New Fuels. Propellant fuels and their utilization are discussed. ***C. H. Johnson.*** *Chemical Society, Proceedings*, 1959, Aug., p. 212-221.

499* The Murton Coking Plant. I. Describes National Coal Board's Durham Division works noted for its high degree of centralized automatic plant control. *Coke and Gas*, v. 21, Aug. 1959, p. 306-315 + 1 plate.

500* Physical and Chemical Properties of the Petrographic Components of a High Volatile Bituminous Coal. ***Sabri Ergun, James T. McCartney, and Morris Mentser.*** *Economic Geology*, v. 54, no. 6, Sept.-Oct. 1959, p. 1068-1077.

501* Extraction Experiments on Coal With Various Pyridine Bases. A study of coal extraction with a series of closely related pyridine bases and comparison of results with the sequence of basic strength of these bases towards mineral acids, trimethylboron, and phenols indicates that acid-base interaction is sufficient to explain the relative solvation power of pyridine bases for coal. ***A. Halleux and H. Tschamler.*** *Fuel*, v. 38, no. 3, July 1959, p. 291-294.

502* Effect of Ferrocene on Carbon Formation From Acetylene. Effect was found to involve surface reactions. Experimental details and qualitative results are described. ***J. D. Frazee and R. C. Anderson.*** *Fuel*, v. 38, no. 3, July 1959, p. 329-331.

503* Fluidized Combustion of Solid Fuels. Explores the development of new combustion mechanisms by aerodynamical and thermodynamical principles of fluidized reactions. First commercial prototype large steam generator with fluidized combustion chamber is operating. It is hoped this mechanism will serve as a tool to useful application of low grade coal in the future. *(In Japanese.)* ***Keiji Okaniwa and Jintaro Suzuki.*** *Fuel Society of Japan, Journal*, v. 38, no. 387, July 1959, p. 429-437.

504* Several Problems of Heavy Oil Combustion. Describes several problems on combustion of heavy oil from results of studies. *(In Japanese.)* ***Takezo Obata.*** *Fuel Society of Japan, Journal*, v. 38, no. 387, July 1959, p. 438-447.

505* The Method of Investigation of the Process of Thermal Decomposition of Solid Fuel. Definition of the kinetic characteristics of three groups of parallel reactions according to experimental data on high-speed thermal decomposition of Moscow coal. It is possible to control the quantity and quality of products of decomposition of fuel. When isothermal conditions are approached, it is possible to change the quality and quantity of decomposition products considerably. *(In Russian.)* O metodike issledovaniia protsessa termicheskogo razlozheniia tverdogo topliva. ***A. P. Kashurichev.*** *Inzhenerno-Fizicheskiĭ Zhurnal*, v. 2, no. 9, Sept. 1959, p. 38-46.

506 Flameless Burner Puts the Heat Where It's Needed. High-temperature hand torch is fed from outside to inside surface. This "inshot" burner uses a minimum area for combustion, which results in higher plasma temperatures—over 3000 F for a unit burning a natural gas-air mixture. *Machine Design*, v. 31, Sept. 17, 1959, p. 30 + 1 page.

507 New Developments and Techniques in Delayed Coking. ***Valentine Mekler and Maurice E. Brooks.*** *Petroleum Engineer*, v. 31, Sept. 1959, p. C7-C14.

508* Inflammability and Electrical Studies of Foams Which May Occur at Altitude by De-Aeration of Aviation Turbine Fuels. ***B. V. Poulston and A. Thomas.*** *Royal Aeronautical Society, Journal*, v. 63, Oct. 1959, p. 581-588.

See also: **99** (coke desulfurization).

GEOLOGY, GEOPHYSICS, MINERALOGY, AND MINING ENGINEERING

509* New Data on Tectites. Description of Philippines tectites containing balls of magnetite concentrated on their surface. This material was connected with other investigations showing that magnetite balls 3 to 6 μ (rarely up to 25μ) in diameter, and of meteorite origin, fall upon the earth's surface. *(In Russian.)* Novye dannye o tektitakh. ***G. G. Vorob'ev.*** *Akademiia Nauk SSSR, Doklady*, v. 128, no. 1, Sept.-Oct. 1959, p. 61-62.

510* On the Method of Determining Rare and Dispersed Elements in Magmatic Rocks. Data are presented on a method of concentrating assays of erupted rocks for determining rare and dispersed elements contained in them. The concentration is effected by removing silicic acid. Preliminary results indicate that this method considerably facilitates the determination of Cr, V, Cu, Pb, Sn, Zn, Ni, Be, Zr, Ga, Nb, and Sc, the concentration of which is increased 3 to 5 times as a result of applying this method. *(In Ukrainian.)* Do metodyky vyznachennia ridkykh ta rozciianykh elementiv v magmatychnykh girs'kykh porodakh. ***E. S. Burkser and B. F. Mickiewicz.*** *Akademiia Nauk Ukraïns'koï RSR, Dopovidi*, 1959, no. 8, p. 874-877.

511* Pennsylvanian Oil Possibilities of San Juan Basin, Four Corners Region. ***Sherman A. Wengerd.*** *American Association of Petroleum Geologists, Bulletin*, v. 43, Sept. 1959, p. 2214-2227.

512 The Canadian Mineral Industry, 1955. Reviews of the metals and minerals produced in Canada on a commercial scale during 1955, as well as a few others, which, while not produced in Canada, are important to industry. *Canada, Division of Mines, Report No.* 862, 1959, 278 pp. (Tn41 C16re Vis.)

513 Oceanography: Defense Must. Claims that warm water pockets and magnetic fields can conceal submarines. Lists Soviet efforts. ***Electronics,*** v. 32, no. 38, Sept. 18, 1959, p. 18 + 2 pages.

514* The Cosmogenic He^3 and He^4 Distribution in the Meteorite Carbo. The He^3/He^4 ratio is approximately constant throughout most of the cross-section and has a value of 0.239. The amount of He^3 varies between the approximate limits of $3{\cdot}2$ and $4{\cdot}6 \times 10^{-6}$ std. cm^3/g of meteorite. ***J. H. Hoffman and A. O. Nier.*** *Geochimica et Cosmochimica Acta*, v. 17, nos. 1-2, Aug. 1959, p. 32-36.

515* The Metallic Particles of Some Chondrites. ***H. C. Urey and Toshiko Mayeda.*** *Geochimica et Cosmochimica Acta*, v. 17, nos. 1-2, Aug. 1959, p. 113-124 + 11 plates.

516* On the Radiometric Method in the Search for Gas-Oil Deposits. Samples of the surface layer of rocks at a depth of 25 *cm* on gas-condensate deposit underground structure were analyzed to find out the causes of the typical distribution of intensity of γ-radiation which is observed on several oil-bearing areas. Results showed that the distribution of γ-radiation is connected with a parallel concentration change of all radioactive elements (U, Ra, Th and K). Radon is contained in oil gases in quantities not sufficient to cause the observed change of intensity of γ-radiation along the outline of the deposit. *(In Russian.)* K voprosu o radiometricheskom metode poiskov gazoneftianykh mestorozhdeniĭ. ***V. I. Baranov, et al.*** *Geokhimiia*, 1959, no. 6, p. 530-537.

517* Formation of Heavy Gaseous Hydrocarbons During Anaerobic Decomposition of Organic Matter. The concentration of heavy gaseous hydrocarbons in gaseous products of decomposition constitutes 10^{-1} to 10^{-6}%. It is important to know that the origin of ethane, propane, and butane by anaerobic decomposition is one link of the chain in the conversion process of organic matter into crude oil. *(In Russian.)* Obrazovanie tiazhelykh gazoobraznykh uglevodorodov pri anaerobnom razlozhenii organicheskikh veshchestv. ***E. N. Bokova.*** *Geologiia Nefti i Gaza*, v. 3, no. 8, Aug. 1959, p. 44-47.

518 Ground Water Hydrology. A unified, comprehensive account of the fundamentals and recent methods and problems encountered is presented. Covers location, capacity, and dangers of pollution. ***David K. Todd.*** 336 pp. 1959. John Wiley & Sons, New York. (GB1003 T56g)

519* Geochemistry of Isotopes. The isotopic exchange reactions, particularly those involving lighter atoms, are intensive in the outer shell of the earth, notably in the biosphere. The biospheric exchange reactions are primarily responsible for local enrichments and anomalous absences of various isotopes, especially those of O, C, S, and H. ***A. P. Vinogradov.*** *International Geology Review*, v. 1, Aug. 1959, p. 1-13. (Translated from the Russian by ***V. P. Sokoloff.)***

520* Aerial Photographs and Structural Geomorphology. Attempts to present a usable revision of geomorphic concepts mainly through two basic principles: the concept of essentially universal superposition of drainage in "flatland" regions, as well as in most tectonic systems; and the concept of an almost universal tectonic influence on most continental drainage. ***Frank A. Melton.*** *Journal of Geology*, v. 67, no. 4, July 1959, p. 351-370.

521* Doppler Investigations of the Radar Aurora at 400 Mc. Doppler shift of auroral echoes has been determined as a function of the parameters: azimuth angle of the radar ray; off-perpendicular intersection angle of the radar ray and the earth's magnetic field; elevation angle of the radar ray; range of the echoes; altitude of the reflection centers; time of day; number of occurrences; strength of the echoes. ***R. L. Leadabrand, R. I. Presnell, M. R. Berg, and R. B. Dyce.*** *Journal of Geophysical Research*, v. 64, no. 9, Sept. 1959, p. 1197-1203.

522* Analysis of Stratospheric Strontium^{90} Measurements. The Sr^{90} data are shown and compared with estimates of the amount injected into the stratosphere. Limitations of the data are discussed. ***L. Machta and R. J. List.*** *Journal of Geophysical Research*, v. 64, no. 9, Sept. 1959, p. 1267-1276.

523* Treatments to Improve the Performance of Injection, Disposal and Water Supply Wells. ***J. M. Moore and J. T. Rollins.*** *Journal of Petroleum Technology*, v. 11, Sept. 1959, p. 37-41.

524* Phenomena Affecting Drilling Rates at Depth. Reduction in penetration rate owing to an increase in the strength of the rock downhole is governed by the difference between the mud pressure and the pressure of the formation pore liquid. Rotationally symmetric geostatic stresses have no effect on drillability. ***A. J. Garnier and N. H. van Lingen.*** *Journal of Petroleum Technology*, v. 11; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 216, Sept. 1959, p. 232-239.

525 The Manual of Micropaleontological Techniques. Provides reprints of the scattered small articles on techniques which appear in various geological and paleontological journals. Sections individually paged. 1959. McLean Paleontological Laboratory, Alexandria, Virginia. (QE721 M22m Over.)

526 Geology of the Ross-Adams Uranium-Thorium Deposit, Alaska. Only source of U ore in Alaska that has been mined commercially. Uranothorite and uranoan thorianite are the chief ore minerals. ***E. M. MacKevett, Jr.*** *Mining Engineering*, v. 11, Sept. 1959, p. 915-919.

527* DMEA Project Blossoms Into Best U. S. Mica Mine. Guides to discovery were known but unexplored pegmatites contain significant amounts of sheet mica. Mica-rich shoots have the same attitude as major linear features of country rock. Favorable areas are those underlain by hornblende gneiss and mica schist. Drag-folded and faulted layers are logical places to search for blind pegmatites. ***Dewey H. Amos.*** *Mining World*, v. 21, no. 11, Oct. 1959, p. 30-34.

528* The Use of Deep Freezing in Preparing the Zone Around the Actual Drilling Operation. The first materials corresponding to some physical parameters of rocks and petroleums under deep freezing conditions (−195.6 C) were obtained. A new method, based on low temperature reaction, was devised to obtain a temporary sealing of the filtration surface near the boring place of the shelf in wells. *(In Russian.)* Ispol'zovanie glubokogo okhlazhdeniia dlia obrabotki prizaboĭnykh zon. ***M. A. Geĭman, V. S. Uzoler, and V. I. Shenaeva.*** *Neftianoe Khoziaĭstvo*, v. 37, no. 9, Sept. 1959, p. 42-46.

529* Ocean Currents. ***James Crease.*** *New Scientist*, v. 6, Sept. 10, 1959, p. 402-404.

530* The Atmosphere and the Ocean. Currents in the ocean, other than tidal, are maintained by energy which comes from thermonuclear reactions in the sun, but by complicated processes involving the atmosphere. ***Henry Charnock.*** *New Scientist*, v. 6, Sept. 17, 1959, p. 465-467.

531* New Drilling Fluids Harden Shales. The approach used was to develop an environment which would stabilize the troublesome shale and then develop a mud which would incorporate this environment. ***Walter J. Weiss, Wilbur L. Hall, and Richard H. Graves.*** *Oil and Gas Journal*, v. 57, no. 41, Oct. 5, 1959, p. 147 + 6 pages.

532* Geoacoustic Spectrum. Benefits from utilizing the entire spectrum are stressed. ***Charles H. Thurber.*** *Oil and Gas Journal*, v. 57, no. 42, Oct. 12, 1959, p. 228 + 4 pages.

533 Geology and Mineral Resources of Bucks County, Pennsylvania. ***Bradford Willard, et al.*** *Pennsylvania Topographic and Geologic Survey, Bulletin* C-9, 1959, 243 pp. (QE157 P38.7bg Vis.)

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535 Two Liquid System Resulting From Addition of LPG and Gas to an Oil. Laboratory studies can help anticipate difficulties. ***J. G. Roof and N. W. Crawford, Jr.*** *Petroleum Engineer*, v. 31, Sept. 1959, p. B32-B34.

536 Scientific Programming on the Rig Floor to Obtain Optimum Bit Life. A formula to eliminate some of the guesswork related to the drilling industry's biggest everyday decision. ***William K. Holstein.*** *Petroleum Engineer*, v. 31, Sept. 1959, p. B125-B126.

537* Problem of Sub-Surface Development of Off-Shore Oil Fields. Operations under the Caspian Sea are considered. ***V. S. Melik-Pashaev.*** *Petroleum Geology*, v. 2, no. 8-B, 1958, p. 747-750.

538* Geophysical Methods of Study of Reservoir Properties of Rocks. ***V. N. Dakhnov.*** *Petroleum Geology*, v. 2, no. 8-B, 1958, p. 753-763.

539* Miscible Drives Ousting Waterfloods? Advantages of miscible drives are detailed. *Petroleum Week*, v. 9, no. 12, Sept. 18, 1959, p. 31 + 1 page.

540* Frac Experiment Pays Off Two Ways. Continental Oil Co.'s experimental fracturing program in Southwest Texas. *Petroleum Week*, v. 9, no. 13, Sept. 25, 1959, p. 20 + 2 pages.

541 The Production of Ice Crystals by Large Adiabatic Expansions of Water Vapour. No evidence was obtained for a sudden increase in the crystal production or a change in their mode of formation at about −65 C as suggested by expansion chamber experiments of other workers. ***J. Maybank and B. J. Mason.*** *Physical Society, Proceedings*, v. 74, pt. 1, July 1959, p. 11-16.

542* Nitric Oxide and Molecular Oxygen in the Earth's Upper Atmosphere. Determined the concentration of NO and O in the altitude interval 63 to 87 km. ***A. S. Jursa, Y. Tanaka, and F. LeBlanc.*** *Planetary and Space Science*, v. 1, no. 3, Aug. 1959, p. 161-172 + 4 plates.

543* The Relation Between Lightning Discharges and Whistlers. Anomalous behavior is described. ***Harald Norinder and Edgar Knudsen.*** *Planetary and Space Science*, v. 1, no. 3, Aug. 1959, p. 173-183.

544* Artificial Electron Clouds. I. Summary Report on the Creation of Artificial Electron Clouds in the Upper Atmosphere. ***F. F. Marmo, L. M. Aschenbrand, and J. Pressman.*** *Planetary and Space Science*, v .1, no. 3, Aug. 1959, p. 227-237 + 1 plate.

545 Proceedings of the Illinois Mining Institute. Annual meeting at Springfield, Illinois on October 24, 1958. v. 66. 251 pp. 1958. (TN1 16p Vis.)

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547* Mars Observations at the Pic du Midi. Describes the equipment of Pic du Midi. Contains excellent photographs of the planet Mars taken during 1941 and 1956. ***Henri Ca-***

michel. *Sky and Telescope*, v. 18, no. 11, Sept. 1959, p. 600-604.

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550 Prospecting in Washington. A guide to beginning prospectors. ***Donald L. Anderson.*** *Washington (State) Division of Mines and Geology, Information Circular No.* 31, 1959, 26 pp. (QE175 W27.5i Contin.)

551* Origin and Significance of Mineral Components in Crude Oils. The origin of mineral components in crude oils is discussed. The technological and geochemical significance of some metallic elements in crude oils and products of its manufacturing is given. *(In Polish.)* Geneza i znaczenie składników mineralnych w ropach naftowych. ***Zbigniew Gregorowicz.*** *Wiadomosci Chemiczne*, v. 13, July 1959, p. 349-357.

552* Can the Earth's "Crust" Be Penetrated? Can be expected within four years, providing oil industry know-how and equipment can be obtained. ***Don E. Lambert.*** *World Oil*, v. 149, Oct. 1959, p. 128-131.

See also: **490** (transport theory of particle clouds).

GRAPHIC ARTS

553* The Printing Quality of Newsprint. Some of the factors affecting it. ***R. W. Prince.*** *American Pressman*, v. 69, no. 9, Sept. 1959, p. 10 + 2 pages.

554* A Refreshing Interlude on Ink. Address presented by Dr. Neville before the Fifth International Conference of Printing Research Institutes. Discusses history of the art of printing. ***Harvey A. Neville.*** *American Pressman*, v. 69, no. 9, Sept. 1959, p. 17 + 3 pages.

555 High Speed Photography for Chemical Engineering. The increasing skill with which chemical engineers use special photographic techniques in their research is demonstrated in the five papers reviewed here covering extreme conditions varying from single still shots of meaningful streak images of the desired objects, to the use of motion pictures taken at speeds as great as 1,500,000 frames/sec. ***J. W. Westwater.*** *Chemical Engineering Progress*, v. 55, June 1959, p. 49-53.

556* Modern Developments in Infra-Red Recording. During the war, infra-red image converters were used by the armed forces for "seeing in the dark". These and other techniques for making infra-red images visible have advanced rapidly and are bringing greater flexibility to photography, cinematography, and television. ***C. E. Engel.*** *Discovery*, v. 20, Sept. 1959, p. 392-396.

557* Oscilloscope Trace Recording With Polaroid Land Photography. I. Films and Cameras. *Kemon P. Taschioglou and Hy P. Mansberg.* *Electronic Design*, v. 7, no. 19, Sept. 16, 1959, p. 28-33.

558 2nd Annual Diazo Section. Devlopments—Techniques—Applications. Directory of reproduction machinery. *Industrial Photography*, v. 8, Oct. 1959, p. 23-27.

559* Photographic Sensitivity. Discusses the significance of sensitivity in modern times. ***K. V. Chibisov.*** *Journal of Photographic Science*, v. 7, no. 3, May-June 1959, p. 41-54.

560* The Kodak Startech Camera Outfit. A simple camera for close-up medical photography. ***H. L. Gibson.*** *Medical Radiography and Photography*, v. 35, no. 1, 1959, p. 9-16.

561* A Method of Contrast Control in Continuous-Tone Xerography. A method of contract control is described suitable for xerographic printing of continuous-tone photographic negatives. The xerographic plate consists of a thin, photoconductive layer of vitreous selenium deposited on a conductive backing. It is sensitized by charging the selenium layer to a uniform potential. Exposure to an optical image produces a corresponding electrostatic image by partial photoconductive discharge of the surface. This image is developed with an aerosol containing charged black particles, the aerosol passing between the plate and a closely spaced electrode. ***J. T. Bickmore, R. E. Hayford, and H. E. Clark.*** *Photographic Science and Engineering*, v. 3, no. 5, Sept.-Oct. 1959, p. 210-214.

562* An Edge Effect in Color Films Caused by Distortion of the Developed Image When a Hardening Bleach Is Used. The source of the effect is shown to be a distortion of the developed image resulting from differential hardening of gelatin in image and non-image areas during bleaching, and subsequent dislocation during drying. Variables affecting this effect are described. The photographic effect of this phenomenon is illustrated for Eastman Color Intermediate Film, Type 5253. ***Hobson J. Bello, Jr. and Daan M. Zwick.*** *Photographic Science and Engineering*, v. 3, no. 5, Sept.-Oct. 1959, p. 221-224.

563* The Tonal Quality in the Black and White Photography. A study establishing a very close relationship between the morphology of the developed silver and the tone quality of the photographic layers. *(In German.)* Der Bildton in der Schwarz-Weiss-Photographie. ***W. Koerber.*** *Photo-Technik und-Wirtschaft*, v. 10, Sept. 1959, p. 414-416.

564* Concerning the Granularity of Non-Uniformly Impressed Photographic Films. The statistical properties of the transparency of photographic films are examined in connection with their granularity. A mathematical model depending upon an only small number of parameters is presented and shown to account suitably for the observed statistical properties. *(In French.)* Sur la granularité des films photographiques uniformément impressionnes. ***Michel Savelli.*** *Revue d'Optique Théorique et Instrumentale*, v. 38, no. 6, June 1959, p. 269-281.

565* An Automatic Loop Printing System. Printing system for 35mm motion-picture films in color and black-and-white has been developed. After a predetermined number of prints, the next negatives are brought into place automatically and printing is resumed after the splicing of the new sound and picture reels. Negative magazines are automatically adjusted for length during the printing and the replacing of the new films. ***Mario Calzini.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Sept. 1959, p. 582-585.

566* New, Compact Light Sources for High-Speed Photography. Small and especially compact incandescent light sources are frequently needed when recording high-speed phenomena in crowded spaces. Self-contained reflector lamps, considerably smaller than previous types and with an improved beam pattern, have been designed. They require no auxiliary equipment and types are available for use on aircraft voltages. ***Willett R. Wilson.*** *Society of Motion Picture and Television Engineers, Journal*, v. 68, Sept. 1959, p. 596-598.

See also: **348** (lithography).

HEAT POWER

567 Radiator Areas of Thermopile Generators in Space. Shows that an optimum cold junction temperature resulting in a minimum required area of radiating surface for given material properties and a given hot junction temperature exists. ***Douglas L. Kerr.*** *Aero/Space Engineering*, v. 18, Sept. 1959, p. 57 + 6 pages.

568* Space Vehicles—Materials and Propellants. Criteria for choice and design of liquid and solid systems are given. ***William T. Read, Sr.*** *Armed Forces Chemical Journal,* v. 13, no. 5, Sept.-Oct. 1959, p. 12 + 2 pages.

569* American Gas Turbine. A Ford power unit with intercooled, two-stage compression, and a dual combustion system. *Automobile Engineer,* v. 49, Aug. 1959, p. 290-291.

570 British Unveil Three Turbine Powerplants. For aircraft. ***David A. Anderton.*** *Aviation Week,* v. 71, Sept. 28, 1959, p. 54 + 3 pages.

571* The Use of Wind Power in Europe. Results of the Annual Conference of the Study Group on Wind Power, Stuttgart. The economic use of standard plants for additional power generation into existing grids will be possible in Central European territories with favorable wind conditions. The first cost of automatically controlled grid-connected wind power generators is estimated at 600 to 750 Dm/kw within about 100 to 300 kw which has been recognized as the favorable range of size. *(In German.)* Windkraftnutzung in Europa? Ergebnisse der Jahrestagung der Studiengesellschraft Windkraft-eV Stuttgart. ***A. Th. Gross.*** *Brennstoff-Wärme-Kraft,* v. 11, Sept. 1959, p. 414-419.

572 Exploring the Super Heats. Discusses in lay terms some of the scientific thought on high-temperature materials. *Business Week,* no. 1571, Oct. 10, 1959, p. 169-170.

573* Small Engines and the "System Concept" for Precise Power. Features American Marc small diesel motor-generators. *Diesel Power,* v. 37, Sept. 1959, p. 75-76.

574* Power for the Long-Range Supersonic Airliner. II. Expounds the applicability of integrated turbo-jet-ramjet power plant. ***R. R. Jamison.*** *Engineer,* v. 208, Aug. 21, 1959, p. 92-95.

575 Thermoelectric Power. An Investigation of Its Possibilities. III. A general discussion and an approximate analysis of the economics involved. ***G. W. Wilson and B. C. Lindley.*** *Engineering,* v. 188, Sept. 11, 1959, p. 161-162.

576 Application of Diesel Engines and Gas Turbines to Rail Transport. Suggests that the diesel can bring to rail traction predictable performance uninfluenced by human vagaries, lower over-all costs, and greater amenity. ***E. S. Cox.*** *Engineering,* v. 188, Sept. 18, 1959, p. 234-236.

577* A Gas Turbine Powerplant for Locomotives. Some gas turbine locomotive developments are reviewed in relation to operating experiences in various parts of the world. ***A. J. Bachmeier, et al.*** *Engineering Journal,* v. 42, Sept. 1959, p. 74-84.

578* Air-Cooled Underfloor Bus Engines. Describes satisfactory operating experience with two experimental public-service vehicles in Winterthur. *Gas and Oil Power,* v. 54, July-Aug. 1959, p. 187-189.

579* Deutz Multi-Fuel Engine Development Facilitated by Air Cooling. ***Richard Kloss.*** *Gas and Oil Power,* v. 54, July-Aug. 1959, p. 205-209.

580 Rocket Propulsion Systems for Interplanetary Flight. Four categories of propulsion systems discussed are; the liquid propellant and solid propellant rockets which generate energy from chemical combustion, those that use nuclear energy as their source of power, those that use electrical or electromagnetic devices for the acceleration of mass, and, finally, those that use electromagnetic radiation (light waves) to obtain a propulsive force. ***George Paul Sutton.*** *Journal of the Aero/Space Sciences,* v. 26, Oct. 1959, p. 609-625.

581 Keeping Turbines Out of Trouble. To increase turbine life, designers must choose materials with strength, wet tolerance, avoid stress concentrations, and avoid resonance. More important, according to NASA, is a program of record keeping giving grounds for predicting failure for any part of the engine. ***S. S. Manson, G. M. Ault, and B. Pinkel.*** *Machine Design,* v. 31, Sept. 17, 1959, p. 24-28.

582* Nuclear Marine Propulsion. Reviews developments in America. ***J. R. Finniecome.*** *Mechanical World and Engineering Record,* v. 139, Aug. 1959, p. 356-361.

583 Big Rockets Multiply MSE Needs. Examples of integrated missile supporting equipment might be special slings for installing an engine and electrical launch controls. New fuels will demand research and development of new support items. ***Henry W. Gilfillan.*** *Missiles and Rockets,* v. 5, no. 39, Sept. 21, 1959, p. 28-30.

584* Ramjet Power for Supersonic Aerial Targets. ***R. P. Reul.*** *Missile Design & Development,* v. 5, Sept. 1959, p. 21-24.

585* The Supersonic Airliner and Its Power-Plant. The ideal speed for such an aircraft, and the relevant engineering problems, are discussed. A possible design is proposed. ***R. R. Jamison.*** *New Scientist,* v. 6, Sept. 17, 1959, p. 460-461.

586* Some Continental Air-Cooled Engines. *Oil Engine and Gas Turbine,* v. 27, July-Sept. 1959, p. 95-96.

587* Damage to Axial Compressors. Describes an experimental approach to assessing the relative merits of different blade materials from the damage point of view. ***J. Dunham.*** *Royal Aeronautical Society, Journal,* v. 63, Oct. 1959, p. 576-580.

588* New Light on Combustion Noise and Vibration. ***R. C. Tupa.*** *SAE Journal,* v. 67, Oct. 1959, p. 80-81.

589 Fuel Cells. Devices that convert chemical energy directly into electricity, thus circumventing the inefficiency of the heat engines used to drive electric generators, are now under intensive development. ***Leonard G. Austin.*** *Scientific American,* v. 201, no. 4, Oct. 1959, p. 72-78.

590 Fluorine Compounds Point to Many New Propellant Possibiliites. Detailed report that shows why F pops up with such regularity—because of its unique chemical characteristics and because of its many promising applications. ***John F. Gall.*** *Space/Aeronautics* (Research and Development Handbook), v. 3, 1959-1960, p. C-5 + 15 pages.

See also: **343** (ceramic coatings for diesel engines); **1073** (propellant effects on polymers and elastomers); **1161** (brazed Mo for jet engine parts).

INFORMATION—PREPARATION AND DISSEMINATION

591* Publication Decisions and Tests of Significance—A Comment. The custom of only publishing research when it reaches a certain degree of significance is likely to lead to errors, not through repetition of the same experiments, but over many different experiments. ***Gordon Tullock.*** *American Statistical Association, Journal,* v. 54, no. 287, Sept. 1959, p. 593.

592 Searching and Updating Easy With Film-Tape Records. Complete sets of engineering drawings, patent claims, business records, catalog data, or legal documents can be found and reproduced quickly by this system that marries microfilm and digital computer tape techniques. Record updating can be done while searching. ***Peter James.*** *Control Engineering,* v. 6, Oct. 1959, p. 128.

593 Copywriting: Theory and Technique. A complete handbook covering mastery of basic written forms for effective expression; skill in advertising copywriting; writing for the chief media of advertising; and applying techniques of promotional, public relations, technical, and report writing. ***George Timothy Clarke.*** 523 pp. 1959. Harper & Brothers, New York. (HF5825 C55c)

594 The Man and the Organization. The extent of communication between the physical and the social sciences leaves much to be desired. One of the principal purposes of this paper is to help communicate some of the knowledge from the social sciences to persons in the physical sciences. ***Martin M. Bruce.*** Paper from "1959 Design Engineering Conference", The American Society of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

595 Modern Trends in Documentation. Proceedings of a symposium held at the University of Southern California in April, 1958. ***Martha Boaz, editor.*** 103 pp. 1959. Pergamon Press, New York. (Z1001 B63m)

596 8 Steps to Better Engineering Writing. Fifth of a series discussing vocabulary, grammar, and punctuation. ***Richard M. Koff.*** *Product Engineering*, v. 30, no. 41, Oct. 5, 1959, p. 47.

597 Russian-English Glossary of Physics of Fluids and Meteorology. This glossary contains the most up-to-date Russian-English vocabulary in the fields of Physics of Fluids and Meteorology. There are over 4,000 terms compiled from the latest Russian and English sources in the field. ***I. Emin, editor.*** 93 pp. 1959. Interlanguage Dictionaries Publishing Corp., New York. (QC5 R92 Ref.)

See also: **525** (manual of micropaleontological techniques).

INSTRUMENTATION

598 An Impedance Bridge for Surface Temperature Measurement. The instrument can operate continuously and detect surface temperature variations of the order of 1 C at temperatures up to 500 C. The measurement technique is applicable to temperature measurement of conductive nonmagnetic bodies. ***R. J. Mouly.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 388-393.

599* Electronic Instruments in Space-Research Vehicles. Description of some rocket-borne instrumentation already developed. ***R. L. F. Boyd.*** *Institution of Electrical Engineers, Journal*, v. 5, no. 56, Aug. 1959, p. 457-463.

600 High-Gain d.c. Amplifier for Biological Purposes. A "starved operation" d.c. amplifier is described, having a drift of less than 100 μV in 30 min, grid current less than 10^{-11} A and a noise level referred to the input of 15 μV with 10MΩ grid resistors. Circuits are also described for using the amplifier with commercial cathode-ray and pen oscillographs. ***S. V. Hill.*** *Journal of Scientific Instruments*, v. 36, July 1959, p. 297-300.

601 Integrating Exposure Meter for Electron Microscopy. The meter depends upon the scattered X-ray emission from the plate being exposed, and ensures correct exposures under diverse conditions. The instrument has proved stable and reliable in operation. ***J. Cartwright and A. E. Bishop.*** *Journal of Scientific Instruments*, v. 36, July 1959, p. 303-304.

602* An Automatic Titration Unit for Chlorides in Biological Fluids. An instrument which could be used by semi-skilled staff to carry out large numbers of estimations with a high degree of speed and accuracy. ***Kenneth G. Gadd.*** *Laboratory Practice*, v. 8, Oct. 1959, p. 323-329.

603* A Coulometric-Titration Coulometer. Highly precise coulometer which permits time integration of currents totaling 100 coulombs or more with a precision of about 1 part in 100,000. ***Stanley W. Smith and John K. Taylor.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 63C, no. 1, July-Sept. 1959, p. 65-68.

LUBRICATION AND FRICTION

604 Design Curves for Journal Bearings. Curves presented for a full journal bearing of finite length illustrate the variation of minimum film height with load variable and the variation of the coefficient of friction with the Sommerfeld number. ***Donald F. Hays.*** Paper from "1959 Design Engineering Conference", The American Society of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

605 Which Bearing and Why? Selection factors and bearing types (fluid film and rolling contact) are covered as well as application data. Emphasis is given to externally pressurized bearings with restrictor control and self-pressurized bearings which show promise in machine-tool applications. ***A. O. DeHart.*** Paper from "1959 Design Engineering Conference", The American Society of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

606* Significance of Specific Lubricant Tests. *Lubrication*, v. 45, Oct. 1959, p. 133-144.

607* Recent Developments in the Lubrication of Heavy Duty Industrial Gearing. Endurance of lubricant film on gear teeth was investigated to determine frequency of application and quantity required when intermittent lubrication methods are employed. Requirements for number and location of spray nozzles to obtain effective and adequate lubricant coverage were investigated. General lubrication recommendations are presented. ***G. P. Maurer.*** *Lubrication Engineering*, v. 15, Sept. 1959, p. 360 + 7 pages.

608* A Laboratory Rating Method for Extreme Pressure Gear Lubricants. A simplified laboratory method for evaluating the load carrying capacities of gear oils under boundary conditions is described. The performances of gear lubricants are compared on an over-all evaluation basis. The system is applied to a group of typical and selected commercial heavy duty gear oils. ***A. J. De Ardo and L. B. Sargent, Jr.*** *Lubrication Engineering*, v. 15, Sept. 1959, p. 367-371.

609* Radiation Stability of Silicone Greases. Static tests were conducted at 38 C on commercial and experimental greases to show their probable limits of radiation stability. ***D. J. Fischer, J. F. Zack, Jr., and E. L. Warrick.*** *Lubrication Engineering*, v. 15, Oct. 1959, p. 407-409.

610 Cast Bronze Sleeve Bearings. Comprehensive manual of principles and practices for simplified design and application of 360-degree cast-bronze bearings. Sleeve-bearing fundamentals; full-film lubrication; complete boundary lubrication; mixed-film lubrication. ***Harry C. Rippel.*** *Machine Design*, v. 31, Sept. 17, 1959, p. 174-206.

611 1800 Mph Skid. Extreme wear and dimensional change in steel sliders used to support and guide rocket sleds. *Machine Design*, v. 31, Oct. 15, 1959, p. 32 + 1 page.

612* Effect of Heat on 12-Hydroxystearic Acid. *M. K. Smith.* *NLGI Spokesman*, v. 23, no. 7, Oct. 1959, p. 271-273.

613* Plastometric Measurement of Flow Properties of Lubricating Greases. Existence of creep phenomenon was ascertained in the lubricating greases used from their flow curves determined by plastometric measurements. It was experimentally shown that syneresis in grease proceeds in direct proportion to creep. The flow property or the firmness of lubricating grease can be approximately expressed by Nutting's empirical formula for the firmness of vico-elastic bodies. ***B. Yamaguchi and T. Oki.*** *NLGI Spokesman*, v. 23, no. 7, Oct. 1959, p. 274-281.

614 High Temperature Solid Film Lubricants for Uses Above 1000° F. Definition of solid film lubricant; selection of lubricant binder; study of friction and wear mechanisms; test equipment. ***Ralph E. Crump.*** *Society of Automotive Engineers, Preprint* 4S, 1959, 12 pp.

615 New Fluoroester Lubricants for High Temperature Applications. Oxidation and thermal stability of esters; physical properties; study of fluoroester lubricants in bearing performance tests. ***E. C. Ballard and E. E. Sommers.*** *Society of Automotive Engineers, Preprint* 9R, 1959, 11 pp.

616 A Study of the Metallurgical Properties That Are Necessary for Satisfactory Bearing Performance and the Development of Improved Bearing Alloys for Service up to 1000 F. Fifty-one experimental compositions were studied. Describes the theoretical considerations which formed the basis of the formulation of these steels as well as the annealing cycle, austenitizing temperature survey, and the tempering survey. The results of the tempering studies are plotted as "master tempering curves". ***T. V. Philip, A .E. Nehrenberg, and G. Steven.*** *U. S. Air Force, Wright Air Development Center,*

WADC Technical Report 57-343, (pt. 2), Oct. 1958, 56 pp. (TL507 Un3.18w Vis.)

MECHANICAL ENGINEERING

617 Torsion of a Prismatical Bar Whose Section Is a Crescent. Problem is solved for a region bounded by two circular arcs forming a crescent. The region is conformally transformed to an infinite strip and the stress function is obtained by Fourier integral. Subsequent quadratures for evaluation of the torsion constant are obtained. Some values of the torsion constant are given, and an approximate formula valid for small "camber" is presented. ***F. Sisto.*** *ASME, Transactions, Series A, Journal of Engineering for Power,* v. 81, no. 4, Oct. 1959, p. 428-432.

618* Manufacturing Engineering. Operations; effectiveness; functions; organization. ***T. R. Bunnell.*** *Automation,* v. 6, Sept. 1959, p. 48-52.

619* Static Control—an Application Appraisal. Converting a conventional machine tool control panel to static control, and the economics involved in the conversion. ***Russel A. Brown and Arthur R. Douglass.*** *Automation,* v. 6, Sept. 1959, p. 82-88.

620 The Design and Application of Belts, Chains, and Gears. Reviews the present state-of-the-art of belts, chains, and gears used in mechanical-power transmission systems. Recent advances and current developmental trends are described. A number of factors to be considered in the selection of the most suitable type of system are discussed and tabulated for convenient reference. ***E. S. Cheaney, C. L. Paullus, and W. C. Raridan.*** Paper from "1959 Design Engineering Conference", The American Society of Mechanical Engineers, New York. 1959, Sections individually paged. (TJ230 D46p)

621 Hydraulic Energy Dissipators. ***Edward A. Elevatorski.*** 214 pp. 1959. McGraw-Hill, New York. (TC555 EL27h)

622* Automatic Fan Testing. Fan performance plotted automatically in test chamber. ***C. H. Pountney, Jr. and D. W. Skipworth.*** *Instrumentation,* v. 12, no. 4, July-Aug. 1959, p. 12-15.

623 New Tool for Stress Analysis. Plastic film that bonds to metal parts shows strain patterns that can be measured quantitatively under polarized light. *Iron Age,* v. 184, no. 11, Sept. 10, 1959, p. 192.

624 Where Drafting Standards Leave Off. Refinements in dimensioning concepts. ***Reginald E. Stanley.*** *Machine Design,* v. 31, Sept. 17, 1959, p. 158-162.

625 Maximum Stresses in Long Cylinders. Combined empirical equations with design charts. Simplified the analysis of maximum stresses in long, thin-walled cylinders which are an integral part of head and shell structures. ***Edward N. Nelson.*** *Machine Design,* v. 31, Sept. 17, 1959, p. 168-172.

626 Mechanics of Machines. Elementary Theory and Examples. Dynamics; simple harmonic motion; velocity and acceleration; valve diagrams; cams; crank effort diagrams; governors; balancing; friction; friction clutches; belt drives and band brakes; spur gearing; gear trains. ***John Hannah and R. C. Stephens.*** 238 pp. 1958. Edward Arnold Ltd., London. (TJ170 H19m)

627* Hydraulic System Analysis. Discussion of systems using booster pump stations with operation depicted by means of hydraulic pressure gradient diagrams; evaluation of pipeline system operating efficiency. ***Lucian A. Spriggs.*** *Pipe Line News,* v. 31, Oct. 1959, p. 24 + 4 pages.

628 Survey Method Evaluates Residual Stresses in Gears. The method developed is the preliminary strain gage step to the standard beam-dissection technique. By giving a rough but quick picture of the stress situation, it promises broader consideration of residual stresses in design. ***E. T. Bergquist and S. M. Lenhoff.*** *Product Engineering,* v. 30, no. 37, Sept. 14, 1959, p. 84-86.

629 Pressure Losses in Pneumatic Systems. Simplification of calculations for pressure drops of components in series. Nomograph method used is an extension of the National Bureau of Standards' "Flow-factor" technique. ***Gil Riske.*** *Product Engineering,* v. 30, no. 44, Oct. 26, 1959, p. 50-54.

630* Multiple Machine Operations—Determining Interferences. Outlines a method for determining and identifying machine downtime losses and suggests methods to predict their values. ***E. A. Cyrol and E. J. Kolod.*** *Tool Engineer,* v. 43, no. 3, Sept. 1959, p. 115-120.

See also: **7** (design of hydraulic systems).

METALLURGY

631 The Fabrication of Tungsten. The outstanding strength of W is illustrated by a comparison of some of its significant physical properties with those of other metals. The effects produced by heating W are discussed. The consolidation of W by powder-metallurgy procedures and by arc melting is summarized. Considerations of importance in primary working, secondary working, and joining are also summarized. ***V. D. Barth.*** *Battelle Memorial Institute, Defense Metals Information Center, DMIC Report No.* 115, Aug. 14, 1959, 57 pp. (TN799.T5 B32.7t Vis.)

632 High Temperature Materials. Papers presented at conference held in Cleveland, Ohio, April 16-17, 1957, sponsored by High Temperature Alloys Committee, Institute of Metals Division, The Metallurgical Society, American Institute of Mining, Metallurgical, and Petroleum Engineers. ***R. F. Hehemann and G. Mervin Ault, editors.*** 544 pp. 1959. John Wiley & Sons, New York. (TN700 M56h)

633 History of The British Iron and Steel Industry From *c.* 450 B.C. to A.D. 1775. ***H. R. Schubert.*** 445 pp. 1957. Routledge & Kegan Paul, London. (HD9521.5 Sch78h)

634 Nuclear Research Points Way to New Ideas in Metalworking. Use of atomic energy in metallurgy. ***R. H. Eshelman.*** *Iron Age,* v. 184, no. 11, Sept. 10, 1959, p. 177-179.

635 Flames and Furnaces. Description of various furnaces for ingot reheating, heat treatment, and refractory firing. ***M. W. Thring.*** *Iron & Steel,* v. 32, nos. 8/9, July-Aug. 1959, p. 379-384.

636 Controlled-Transformation Stainless Steels. Study of these steels and effect of different alloy compositions. ***K. J. Irvine, D. T. Llewellyn, and F. B. Pickering.*** *Iron and Steel Institute, Journal,* v. 192, pt. 3, July 1959, p. 218-238.

637 ICI's New Titanium Plant. Description of plant for electric arc melting of Ti, followed by rolling for production of sheet. ***John Grindrod.*** *Light Metal Age,* v. 17, Aug. 1959, p. 8 + 2 pages.

638 Tungsten for Electric Lamp Filaments. The extraction of the metal from its ores and its manufacture into filaments by compacting, sintering, swaging and wire-drawing are described briefly, and factors influencing the stability of the metallographic structures are discussed in relation to the service behavior of the lamp. ***D. J. Jones and A. Leach.*** *Metallurgia,* v. 60, July 1959, p. 7-11.

639 Aluminized Steel—Its Properties and Uses. ***K. G. Coburn.*** *Metallurgia,* v. 60, July 1959, p. 17-20.

640* Aluminum- and Tin-Based Antifrictional Alloys. A study of the qualities of antifrictional Al-Sn alloys in relation to the Sn content, Sn distribution, properties of the Al-based substratum, and methods used in modifying these properties by means of additions, thermal treatment, welding or plating. *(In French.)* Les alliages antifriction à base d'aluminium et d'étain. ***Ch. Guinard.*** *Métaux Corrosion-Industries,* v. 34, Sept. 1959, p. 317-323.

641 The Preparation and Properties of Three Refractory Beryllides. The beryllium compounds $NbBe_{12}$, YBe_{13}, and

$ZrBe_{12}$ were prepared by arc melting. The zirconium compound apparently had a tetragonal structure corresponding to $ZrBe_{12}$ and a hardness of 790 Knoop and a density of 2.94 g per cm^3. The yttrium compound had a cubic structure corresponding to YBe_{13} and a hardness of 870 Knoop and a density of 2.57 g per cm^3. The niobium compound had a tetragonal structure corresponding to $NbBe_{12}$ and a hardness of 1100 Knoop and a density of 3.14 g per cm^3. ***Walston Chubb and Ronald F. Dickerson.*** *U. S. Atomic Energy Commission, BMI-1327,* Mar. 3, 1959, 17 pp. (UF767 U3b Contin.)

642 Year Book of American Iron and Steel Institute 1959. 298 pp. 1959. American Iron and Steel Institute, New York. (TS300 Am35y Vis.)

See also: **616** (bearing alloys).

METALS—CORROSION

643* Studies on the Metallurgy of Silicon Iron. IV. Kinetics of Selective Oxidation. The selective oxidation of Si-Fe can be rather complicated, and apparently impossible to rationalize in an unequivocal manner. In some temperature regions, notably near 800 and 1000 C, the data seem to obey the familiar parabolic rate law. However, at intermediate temperatures complications were noted, some of which are possibly due to the order-disorder reaction in the Si-Fe solid solution. ***A. U. Seybolt.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 756-759.

644 Atmospheric Corrosion of Steel. Measurement of temperature, and amount of SO_2 and surface moisture, and their effects. ***P. J. Sereda.*** *Industrial and Engineering Chemistry,* v. 51, Sept. 1959, pt. 1, p. 79A-80A.

645 New Ways to Combat Corrosion. Use of chlorinated polyether, glass-polyester laminates, epoxies, high-build coatings, plastics pipe, refractories, titanium, and zirconium are suggested. ***Robert J. Fabian.*** *Materials in Design Engineering,* v. 50, Sept. 1959, p. 94-98.

646 Erosion of Magnesium. Specimens of a Mg alloy containing 8 w/o Al were eroded at a rate of 0.1 in./yr. when exposed at 40 C to deionized water flowing at a velocity of 20 ft./sec. ***Albert H. Peters.*** *U. S. Atomic Energy Commission, DP-377,* June 1959, 8 pp. + 3 plates. (UF767 Un3.1dp Contin.)

647 High-Temperature Water and Steam-Corrosion Behavior of Zirconium-Uranium Alloys. For γ-quenched material, the corrosion rate increases slowly as the U content of the alloy is increased from 10 to 30 w/o. Similar behavior is noted for other heat treatments except for the 850 C furnace-cooled material. The specimens furnace cooled from 850 C show a linear relationship between corrosion rate and U content over the entire range of the alloys studied. ***Stanley Kass.*** *U. S. Atomic Energy Commission, WAPD-TM-167,* July 1959, 20 pp. (UF767 Un3.1wa Contin.)

648* The Mechanics of the Corrosion of Metals in Soil. I. Iron. In a water-saturated soil, the size of the anodic spots on the surface of Fe is determined by the size of the soil particles; the contact zone at the Fe surface acts as a cathodic spot. A slight additional diffusion of O leads to cathodic control of the corrosion process of Fe in the soil. A higher concentration of O in the soil results in anodic control of the corrosion process. In the transition zone (unsaturated-saturated), an alternation occurs between the active and passive state of Fe so that a mixed control of the corrosion process can be encountered. *(In German.)* Beitrag zur Systematik der Korrosion der Metalle im Erdreich. I. Eisen. ***T. Marković and M. Sevdić.*** *Werkstoffe und Korrosion,* v. 10, Sept. 1959, p. 547-555.

See also: **70** (corrosion inhibition with $NaNO_2$); **119** (corrosion in water treatment); **342** materials to resist corrosion); **1050** (plastics for protection against corrosion).

METALS—EXTRACTION AND REFINING

649* Vacuum Melting and Degassing. Principles of vacuum melting and degassing of Fe, Ni, and Co base alloys. Describes different methods of treatment and gives examples showing improvements in properties of various types of alloys. ***J. Suiter.*** *Australian Institute of Metals, Journal,* v. 4, no. 2, Aug. 1959, p. 95-102.

650 Production of Steel by Mixing and Reducing-Alloying Processes, and Treatment of Hot Metal With Slag. Chinese adaptions of European-developed mixing and reducing-alloying processes. Production of ball-bearing and transformer-sheet steels by reducing-alloyiug process. ***H. J. Eckstein.*** *Henry Brutcher Translation No.* 4620, 9 pp. (From *Neue Hütte,* v. 4, no. 4, 1959, p. 250-252.) Henry Brutcher, Altadena, Calif.

651 Amount and Nature of the Oxide Inclusions Suspended in Open-Hearth Steel Baths. Effect of basic open-hearth operations on oxide suspensions and, hence, steel quality. Sampling technique using immersion molds while heat is in progress. ***K. Born and H. Wittstruck.*** *Henry Brutcher Translation No.* 4648, 35 pp. (From *Stahl und Eisen,* v. 78, no. 22, 1958, p. 1514-1525.) Henry Brutcher, Altadena, Calif.

652 Use of Fluid-Bed Process With Hydrogen- and Carbon-Monoxide-Containing Gases for the Reduction of Iron Ores. The existing semitechnical fluid-bed processes for the reduction of Fe ores are intercompared. Reduction with H, CO, and mixtures of the two are compared; the thermal advantages of using CO are emphasized. ***J. Willems and G. Quade.*** *Henry Brutcher Translation No.* 4661, 21 pp. (From *Stahl und Eisen,* v. 79, no. 15, 1959, p. 1058-1064.) Henry Brutcher, Altadena, Calif.

653 Production of Various Steels in Basic Converters. Melting practices for various steels, rimmed and killed, in 28-ton capacity basic converters by top blowing with O, and comparison of their properties with corresponding O.H. steels. Effective desulfurization and dephosphorization. ***S. I. Lifshits.*** *Henry Brutcher Translation No.* 4667, 17 pp. (From *Stal',* v. 18, no. 11, 1958, p. 980-983.) Henry Brutcher, Altadena, Calif.

654 Kinetics of Ladle Degassing in the Vacuum Treatment of Molten Steel. Indicator (gas) method for study of liberation of gases in vacuum treating of steel; H and N contents during vacuum treatment; ladle convection currents. ***G. A. Sokolov and G. N. Oiks.*** *Henry Brutcher Translation No.* 4675, 24 pp. (From *Izvestiya VUZ, Chern. Met.* 1959, no. 1, Jan., p. 47-58.) Henry Brutcher, Altadena, Calif.

655 Ways of Reducing the Top Discard of Heavy Rimmed-Steel Ingots. Distribution of C, Mn, Si, P, and S in 14-ton rimmed-steel ingots. Undesirable effects of prolonged boiling of steel in the mold. ***M. P. Sabiev.*** *Henry Brutcher Translation No.* 4720, 13 pp. (From *Stal',* v. 18, no. 12, 1958, p. 1089-1095.) Henry Brutcher, Altadena, Calif.

656* Changes in Open Hearth Output and in Specific Heat Consumption During the Inter-Repair Period. Maximum quality of steel obtained in the open hearth furnace and the minimum specific heat consumption occur in the second half of the first month or at the beginning of the second month of furnace operation. Short winter repair periods improve furnace operation considerably, increasing the steel output and decreasing the specific heat consumption. *(In Polish.)* Zmiany wydajności pieca martenowskiego i jednostkowego zużycia ciepła w okresie międzyremontowym. ***Jan Mikulski and Maciej Michałowski.*** *Hutnik,* v. 26, nos. 7-8, July-Aug. 1959, p. 271-276.

657 Solve Steel "Freckle" Mystery. Tests exposing true chemical nature, effect upon alloy quality, and way to eliminate "freckles" in A-286 alloy. ***C. E. Smeltzer, Jr.*** *Iron Age,* v. 184, no. 11, Sept. 10, 1959, p. 188-189.

658 Continuous Casting. Description of present horizontal process for cast iron bar. ***Z. Stokowiec.*** *Iron & Steel,* v. 32, nos. 8/9, July-Aug. 1959, p. 375-378.

659 A Review of Steelmaking Processes. A review of the traditional methods of steelmaking, a heat balance for each process, and an outline of the factors underlying the selection of the method employed for different local conditions. ***T. P. Colclough.*** *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 201-215.

660 Nitrogen Quench of Experimental Blast Furnace. ***J. J. Bosley, Norwood B. Melcher, and M. M. Harris.*** *Journal of Metals*, v. 11, Sept. 1959, p. 610-615.

661* The Electric Smelting Furnace for Reducing Iron Ores in a Fluidized Bed. The electric fluidized bed furnace has proved its functional ability on a semi-technical scale. It can operate on a charge of fine grained raw material, and has a high capacity. It is well suited for the prereduction of ores. *(In German.)* Der Elektro-Fliessbett-Reduktionsofen. ***Werner Wenzel.*** *Stahl und Eisen*, v. 17, no. 79, Aug. 20, 1959, p. 1183-1186.

662* Induction Stirring of Metal in Steelmelting Arc Furnaces. The proposed scheme of the low frequency gas-filled tube rectifier for feeding and induction stirring has advantages as compared with the motor-generator system. *(In Russian.)* Induktsionnoe peremeshivanie metalla v dugovykh staleplavil'nykh pechakh. ***M. G. Rezin, E. K. Kochnev, Ia. I. Drobinin, and N. S. Golubev.*** *Stal'*, v. 19, no. 8, 1959, p. 713-714.

663 Extraction of Uranium, Magnesium, Zirconium, and Cerium From Bismuth With a Fused Fluoride Salt Mixture. A molten mixture of NaF and ZrF_4 was used. Comparative rates of extraction and the effects of high concentrations of Mg and HF sparging on the extraction process were investigated. ***Max D. Adams, Jack Fischer, Robert J. Meyer, and Norman D. Phillips.*** *U. S. Atomic Energy Commission, ANL-6017*, June 1959, 18 pp. (UF767 Un3.1an Contin.)

See also: **357** (surface preparation for protective coatings).

METALS—FINISHING, POLISHING, AND CLEANING

664* Results of Experiments on Shot Blasting of Cast Iron With Various Grits. An investigation of the effects of various types of shotblasting grits on the occurrence of enamel boil defects is described. Experiments were carried out in hand blast cabinets at various plants, using several types of grit. ***A. D. Morgan and J. M. Greenhill.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 13, Aug. 1959, p. 790-798 + 14 plates.

665* Powder-Metal Media for the Tumbling Barrel. New method for obtaining accurate and consistent results in barrel finishing. ***Kenneth M. Gleszer and Andre P. Sampou.*** *Machinery (New York)*, v. 66, no. 1, Sept. 1959, p. 135-137.

666 Machining in Barrels. ***D. J. Fishlock.*** *Metal Industry*, v. 95, Sept. 4, 1959, p. 79-81.

667* When Cleaning Aluminum. Solvent cleaners, emulsifiable solvents, emulsion cleaners, hot alkaline cleaners, etch-type alkaline solutions, acid cleaners, solvent vapor degreasing, electrocleaning, ultrasonic cleaning. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 38 + 3 pages.

668* For a Good Mechanical Finish. Describes processes and equipment for finishing Al, including grinding, polishing, barrel finishing, and blasting. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 48 + 6 pages.

669* Chemical Finishing of Aluminum. A wide range of chemical treating processes has been developed over the past 10 or 12 years. The more important ones are described, including etching, desmutting, coatings, modified Bauer-Vogel process, brightening methods, and chemical polishing. *Modern Metals*, v. 15, no. 8, Sept. 1959, p. 64 + 6 pages.

670 Preparing Zircaloy-2 for Autoclave Testing. The Pickling and Rinsing Process. Chemical and corrosion properties of Zircaloy-2; chemistry of the pickling process. Facilities, materials of construction, and pickling and rinsing procedures. ***D. W. Shannon and B. Griggs.*** *U. S. Atomic Energy Commission, HW-60433*, July 1, 1959, 78 pp. (UF767 Un3.1hw Contin.)

671* Modern Pickling and Yellow Pickling Plants. Mechanical equipment required for pickling, regeneration of pickling baths, heating of pickling tanks, destruction of toxic vapors, and materials for pickling tanks. ***Eberhard Keetman and Otto Saurebau.*** *Wire and Wire Products*, v. 34, Sept. 1959, p. 1085 + 5 pages.

See also: **337** (phosphating of iron and steel).

METALS—FOUNDRY PRACTICE

672* Control of the Moulding Properties of Clay-Bonded Sand by Means of the Green Strength and Shatter Tests. Shows that two entirely independent parameters, green strength and green deformation, influence the stripping of a mould from a pattern and that no single test can give the information required. Direct measurement of deformation is difficult, but the necessary control can be maintained by keeping green strength and shatter index within the appropriate limits. ***W. B. Parkes.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 13, Aug. 1959, p. 736-744 + 2 plates.

673 Inclusions [Black Spots] in Magnesium-Treated Cast Iron and Ways of Suppressing Them. Nonuniform distribution of elements in nodular Fe. Recommended shop practice for cryolite treatment of Ni-Mg inoculated cupola Fe. ***V. M. Korolev.*** *Henry Brutcher Translation No. 4651*, 11 pp. (From *Liteinoe Proizvodstvo*, 1959, no. 5, May, p. 17-18.) Henry Brutcher, Altadena, Calif.

674* Some Tests With Zirconia Sand. Laboratory characteristics and application properties of a sand-refractory clay mixture to be used either for the lining of small cast steel pockets or as very refractory molding sand for casting steel in the parts of molds overheated by the metal. *(In French.)* Conseils pratiques aux fondeurs. *Fonderie*, no. 163, Aug. 1959, p. 380-384.

675 New Technique for Better Titanium Castings. ***M. L. Torti.*** *Journal of Metals*, v. 11, Sept. 1959, p. 616-618.

676 Core Room Practice. Use of corn cereal binder in cores for casting Al and Mg. *Light Metal Age*, v. 17, Aug. 1959, p. 15-16.

677* Tellurium Inoculated Malleable Iron. Tellurium is used for the formation of cementite on the surface of cast Fe. The Te inoculation is recommended in cases where it is necessary to obtain very thick-walled castings from malleable cast Fe. *(In Russian.)* Modifitsirovannyi tellurom kovkiĭ chugun. ***D. N. Khudokormov, V. A. Voroshilov, and N. M. Galanova.*** *Liteĭnoe Proizvodstvo*, 1959, no. 8, Aug., p. 36.

678* High-Speed Melting. Requirements for and description of a new high-speed melting furnace. ***J. G. Winget.*** *Modern Castings*, v. 36, Sept. 1959, p. 44-47.

679* Introduction of Tentative Hot Shell Deformation Test. Literature references are cited which establish that instrumentation and test methods have been developed to evaluate the deformation changes which occur near the surface of conventionally formed mold walls subjected to molten metal. According to these references, these "hot deformation" data have been correlated with the quality of cast surfaces produced by molds of duplicate composition. The results are a guide to the selection of molding materials, molding methods and casting design to develop optimum castings. ***Roderick J. Cowles.*** *Modern Castings*, v. 36, Sept. 1959, p. 51-54.

680* Mn-V-Mo Age-Hardening Austenitic Steel. Foundry Characteristics. Casting, heat treatment, and tensile properties of this steel are discussed. ***N. C. Howells and E. A. Lange.*** *Modern Castings*, v. 36, Sept. 1959, p. 55-58.

681* New Aluminum Die-Casting Alloy. Casting procedure, mechanical and physical properties, heat treatment, and applications for new alloy 364 used for structural applications

which require tensile strength and high elongation or toughness. ***J. H. Moorman and E. V. Blackmun.*** *Modern Castings*, v. 36, Sept. 1959, p. 70-72.

682* Some Principles for Producing Sound Al-7Mg Alloy Castings. Principles were developed for the production of sound horizontal castings of the Al-7Mg alloy. They were developed from a study of the relationship that exists between the thermal gradients at the center line of the casting and various conditions such as the size of the casting as well as the location of gates, risers and chills. Numerous embedded thermocouples established the thermal history during solidification of the castings. The experimental work was performed on elementary shapes—plates and bars. ***W. H. Johnson and J. G. Kura.*** *Modern Castings*, v. 36, Sept. 1959, p. 73-90.

683* Optimum CO_2 Molding. The problems of the sodium silicate-carbon dioxide method of bonding sand cores and molds have been recognized and enumerated in many references. A principal difficulty, collapsibility, is obviated in this work by establishing simple laboratory test methods to determine an optimum quantity of sodium silicate binder. ***Roderick J. Cowles.*** *Modern Castings*, v. 36, Sept. 1959, p. 91-114.

METALS—HEAT TREATMENT

684* The Magnetic Properties of Steels as a Basis of Magnetic Structural Analysis. On the basis of a study of the magnetic and mechanical properties of a number of structural and instrumental steels after hardening and tempering within a wide range of temperatures, and also on the basis of a study of the temperature dependency of the magnetic properties of steels (from −196 to +300 C), a new magnetic method is offered to control the heat treatment of steel parts subjected to high temperature tempering (370-700 C). (*In Russian.*) Magnitnye svoĭstva staleĭ kak osnova magnitnogo strukturnogo analiza. ***G. S. Tomilov, M. N. Mikheev, and M. F. Pomukhin.*** *Fizika Matallov i Metallovedenie*, v. 8, no. 2, Aug. 1959, p. 176-181.

685 New Heating Method Licks Sprocket Hardening Problem. Description of liquid flame hardening and spin quenching method. *Iron Age*, v. 184, no. 11, Sept. 10, 1959, p. 190-191.

686 The Effect of Copper on Martensite Breakdown and Hardenability of a 0·3% C Steel. ***A. S. Kenneford.*** *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 215-217.

687 The Tempering of 2¼% Cr-1% Mo Steel After Quenching and Normalizing. A 2¼% Cr-1% Mo steel has been tempered systematically for times up to 1,000 h in the temperature range 400-750 C after both quenching and cooling at 300 C/h from the austenite range. The hardness changes which occurred have been measured and the accompanying microstructural changes studied. The carbides precipitated were extracted by the direct C extraction technique and examined by electron microscopy X-ray, electron diffraction, and by X-ray fluorescence analysis. ***R. G. Baker and J. Nutting.*** *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 257-268.

688* Carbo-Nitriding. Study of carburizing. Use of low temperature operation; atmospheres used; control of the temperature at which moisture in the atmosphere begins to condense; the different furnaces and best processes applied when town gas is used. (*In French.*) La Carbonitruration. ***D. Flament.*** *Métallurgie et la Construction Mécanique*, v. 91, Sept. 1959, p. 641 + 2 pages.

689* Induction Hardening of Rolls for Cold-Rolling. Rolls 250 mm. in diameter were induction hardened with 200 kW and 2000 Hz. Rolls between 250 and 550 mm. in diameter were induction hardened with grid frequency currents for which a simple apparatus consisting of battery condensers was constructed. Harder rolls, shorter heating time, a 12 to 15% electrical power economy, almost complete elimination of warping, and greater economy were obtained. (*In Polish.*) Hartowanie indukcyjne walców do walcowania na zimno. ***Marian Chyla.*** *Wiadomosci Hutnicze*, v. 15, July-Aug. 1959, p. 223-230.

METALS—MECHANICAL AND PHYSICAL PROPERTIES

690* Changes in Certain Physical Properties of Metals Caused by Fatigue. It is possible to predict fatigue damage by the change of magnetic permeability. The investigation results permit carrying out intermediate annealing under the most favorable conditions and to avoid the formation of microcracks in the metal. (*In Russian.*) Ob izmeneii nekotorykh fizicheskikh svoistv metallov v protsesse ustalosti. ***N. S. Akulov and V. A. Franyuk.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 3, Mar. 1959, p. 87-90.

691* The Effects of Sulfur on the Notch Toughness of Heat-Treated Steels. Reports the results of studies of the impact properties of quenched and tempered alloy-steel plates as a function of S content. It was found that the impact energy levels decreased continuously as the S content increased and that there was a straight-line relationship between impact energy and S content when plotted on logarithmic coordinates. Cross rolling raised the level of these lines for transverse tests and lowered the level for longitudinal tests proportionately to the amount of cross rolling. ***J. M. Hodge, R. H. Frazier, and F. W. Boulger.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 5, Oct. 1959, p. 745-753.

692* Creep of a Dispersion-Hardened Aluminum Alloy. The as-extruded alloy shows an approximate steady-state creep in which the creep rate depends exponentially on the applied stress. The activation energy of creep is approximately 150,000 cal per mole. The recrystallized alloy shows no steady-state creep. ***G. S. Ansell and J. Weertman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 5, Oct. 1959, p. 838-843.

693* Relation Between Beta Grain Size and Ductility of High-Strength Alpha-Beta Titanium Alloy. Effect of β grain size on the tensile ductility of α-β Ti alloys heat treated to strengths in the range 165,000 to 180,000 psi. It was concluded that the primary cause of β embrittlement is the large grain size which is obtained so rapidly in many α-β Ti alloys when heated into the β field. It was also found that grain-boundary α and acicular intragranular α in the microstructure are not necessarily detrimental to the tensile ductility if the prior β grain size is sufficiently fine. ***A. J. Griest, A. P. Young, and P. D. Frost.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Tranasctions, Metallurgical Society*, v. 215, no. 5, Oct. 1959, p. 844-848.

694* Magnetic Investigations of Copper-Iron Alloys. Iron precipitates from the supersaturated Cu solid solution as paramagnetic γ-Fe. The susceptibility decreases. Owing to the plastic deformation of the specimen at low temperatures, a part of the precipitated γ-Fe can be transformed into ferromagnetic α-Fe and thus can be detected. The other phenomena observed in the system can be related to a process in the homogeneous phase, connected with the increase in susceptibility. (*In German.*) Magnetische Untersuchungen an Kupfer-Eisen-Legierungen. ***Erich Scheil, Ernst Wachtel, and Arno Kalkuhl.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 58-65.

695* An Evaluation of the Stress/Strain Properties of Flake Graphite Cast Iron in Tension and Compression. ***G. N. J. Gilbert.*** *B.C.I.R.A. Journal of Research and Development*, v. 7, no. 13, Aug. 1959, p. 745-789 + 2 plates.

696 Mechanical Properties of Tool Steels. Development of methods for testing low-tempered tool steels for mechanical properties under static and cyclic stressing, and results obtained with these methods. ***Ya. B. Fridman and V. P. Konoplenko.*** *Henry Brutcher Translation No.* 4442, 18 pp. (From *Metallovedenie i Obrabotka Metallov*, 1958, no. 12, Dec., p. 2-9.) Henry Brutcher, Altadena, Calif.

697* On the Nature of the Internal Friction in a Hardened and Tempered Steel. The steels investigated contained 0.71 and 0.92% C. At temperatures between 228 and 255 C, maximums of internal friction were observed. These maximums decrease with increase of the tempering temperature and decrease of C content. The values of the peaks have an almost

linear increase with the increase of the amount of residual austenite in the hardened steel. (*In Russian.*) O prirode vnutrennego treniia v zakalennoĭ i otpushchennoĭ stali. ***M. A. Krishtal and S. A. Golovin.*** *Fizika Metallov i Metallovedenie*, v. 8, no. 2, Aug. 1959, p. 294-301.

698* Surface Tension of Liquid Metals and Slags. I. The method of maximal pressure in a bubble was used. The effects of the temperature of materials, time of measuring, geometric dimensions of the capillary tube, depth of its submersion in the melted material, and velocity of bubble formation on the values of surface tension of measured materials were examined. (*In Czech.*) Povrchové napětí tekutých kovů a strusek. ***Ivan Kašik and Jiří Skála.*** *Hutnické Listy*, v. 14, no. 7, July 1959, p. 602-608.

699 Embrittlement of Ultra-High Tensile Steels in Relation to Surface Coatings. Newly-developed steels with tensile strengths of up to 150 tons p.s.i. are shown to fail by embrittlement under constant load, well below their nominal ultimate strength. Describes a program of tests on one specific type of ultra-high tensile steel having C, 0·40; Si, 1·5; Mn, 1·5; Cr, low; Ni, 1·75; Mo, 0·4; and V, 0·2%. ***R. L. Samuel and N. A. Lockington.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 4, Summer 1959, p. 135-141.

700 Hydrogen Embrittlement of Steel by Cathode Charging, Pickling and Cadmium Plating. The effects of electrolytic cathode charging and subsequent aging at various temperatures on the ductility of mild steel screw wire were investigated and the embrittlement resulting from H absorption in routine plating operations was studied on slugs cut from such wire and on C steel coil springs. ***K. Sachs and S. H. Melbourne.*** *Institute of Metal Finishing, Transactions*, v. 36, pt. 4, Summer 1959, p. 142-152.

701 Internal Stresses and Fatigue in Metals. Proceedings of symposium held at Detroit and Warren, Michigan, in 1958. ***Gerald M. Rassweiler and William L. Grube, editors.*** 451 pp. 1959. Elsevier Publishing Co., New York. (TA460 Sy68i)

702 Embrittlement in Steels. Various types of phenomenon, which are shown to produce a profound effect on the behavior of steels under the conditions of the notched bar impact test, are reviewed. ***G. T. Brown and R. T. Allsop.*** *Iron & Steel*, v. 32, nos. 8/9, July-Aug. 1959, p. 385-387.

703 The Stress-Dependent Damping Capacity of Ferromagnetic Metals. ***G. Sumner and K. M. Entwistle.*** *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 238-245.

704 The Mechanical Properties of Hardened High-Speed Tool Steels. An appraisal is given of the methods at present available for testing hardened tool steels in an attempt to evaluate the property of 'toughness'. ***J. Clayton-Cave and E. Ineson.*** *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 248-253.

705* The Hardening and Softening of Ferrite Alloyed With Manganese. Alloying Fe with 1.5 and 3% Mn raises the strength properties in proportion to the increase of the alloying element. The softening of the alloys during heating is delayed and begins at 150 C for an alloy with 1.5% Mn and at 250 C for an alloy with 3% Mn. The increase of internal friction of an alloy with 1.5% Mn begins at a higher temperature than for pure Fe, irrespective of the initial condition of the specimens. (*In Russian.*) Uprochnenie i razuprochnenie ferrita, legirovannogo margantsem. ***L. I. Mirkin.*** *Izvestiia Vysshikh Uchebnykh Zavedeniĭ, Chernaia Metallurgiia*, 1959, no. 6, June, p. 63-66.

706* Properties of Electrotechnical Steel Made With Additions of Phosphorus. Addition of small quantities of P to low-alloy Si steel enables its magnetic properties (when using the critical cold hardening before its vacuum annealing) to be brought up to the level characteristic for the high-alloy hot-rolled electrotechnical steels of the highest grades, and the magnetic induction even up to a somewhat higher level. (*In Russian.*) Svoĭstva elektrotekhnicheskoĭ stali s dobavkami fosfora. ***S. I. Doroshek.*** *Stal'*, v. 19, no. 8, 1959, p. 740-741.

707 Development of Low Alloy Steel Compositions Suitable for High Strength Steel Castings. Cast high strength alloy steels were investigated to develop compositions which had 12% elongation, 30% reduction of area and 15 ft. lb. impact strength when heat treated to 180,000 psi tensile strength. In addition the ultrahigh strength level was studied to determine the tensile strength at which a reduction of area in excess of 10% could be maintained. ***Hugo R. Larson, Ronald C. Campbell, and Herbert W. Lloyd.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-63, June 1959, 106 pp. (TL507 Un3.18w Vis.)

708 The Effects of Solute Elements on the Strength Properties of Iron- and Cobalt-Base Alloys. Factors important in high-temperature deformation were investigated in ternary Fe-Cr-base alloys. These factors include various temperature, strength, and stability criteria, as well as lattice strain and valency changes. Relationships among these criteria are described. Periodicity of alloy strengthening in Co-base binary alloys reveals the most favorable solutes for strengthening, the influence of crystal structure, and the regularity of electronic effects. ***Alan K. Wolff, Ervin E. Underwood, Robert E. Maringer, and George K. Manning.*** *U. S. Air Force, Wright Air Development Center, WADC Technical Report* 59-258, Apr. 1959, 63 pp. (TL507 Un3.18w Vis.)

709 Thermal Expansion of Alpha-Uranium Single Crystals. Dilatometric measurements were obtained between 25 and 650 C in the three principal crystallographic directions. ***L. T. Lloyd.*** *U. S. Atomic Energy Commission, ANL-5972*, June 1959, 48 pp. (UF767 Un3.1an Contin.)

710 Stress Relaxation in Stainless Steel During Irradiation. Neutron irradiation caused elastic stresses that were produced by a fixed amount of deformation to relax as much as 10,000 psi in specimens of Type 304 stainless steel that were loaded in tension and were exposed in a nuclear reactor at a temperature below 100 C. The maximum exposure was 9×10^{20} fast neutrons per square centimeter. ***J. Walter Joseph, Jr.*** *U. S. Atomic Energy Commission, DP-369*, June 1959, 29 pp. (UF767 Un3.1dp Contin.)

711 Mechanical Properties of Uranium Plate. Hot-rolled U plate exhibited a pronounced directionality in mechanical properties which was reduced but not eliminated by β transformation. Results of tensile, bend, impact, and hardness tests made at room temperature are summarized for both hot-rolled and β-transformed U plate. ***George R. Caskey, Jr.*** *U. S. Atomic Energy Commission, DP-376*, June 1959, 22 pp. (UF767 Un3.1dp Contin.)

712 A Remotely Operated Charpy Test Machine for Radioactive Specimens. ***J. R. Hawthorne and L. E. Steele.*** *U. S. Office of Naval Research, NRL Report* 5305, July 13, 1959, 8 pp. (T21 Un3.5n Contin.)

713 An Investigation of the Fatigue Characteristics of Leaded Alloy Steels. An investigation was made to determine the influence of small amounts of Pb on the tensile and fatigue properties of SAE 1018, 1045, 8620, and 4340 steel. Statistical methods were used to determine the mean fatigue limit and the mean fatigue life. ***G. W. Brock and G. M. Sinclair.*** *U. S. Office of Technical Services, PB* 121834, Mar. 1957, 53 pp. (T21 Un3r Contin.)

714 Mechanical Properties of High Purity Fe-C Alloys at Low Temperatures. Results of the second phase of an investigation on several high-purity, low-C irons in the α region of the Fe-C diagram which was made in an attempt to correlate brittle behavior, as defined by the Charpy V-notch transition temperature, with yield-point and fracture data from uniaxial tension tests are summarized. ***G. J. London, G. Spangler, and R. M. Brick.*** *U. S. Ship Structure Committee, SSC-* 93, Mar. 31, 1959, 25 pp. (VM1 Un3.7s Contin.)

715 Mechanical Properties of High Purity Fe-C Alloys at Low Temperatures. ***R. M. Brick.*** *U. S. Ship Structure Committee, SSC-* 94, Mar. 31, 1959, 14 pp. (VM1 Un3.7s Contin.)

716 Fracture Appearance of Impact Specimens Taken From Fractured Ship Plates. Several thousand broken V-notch Charpy specimens from service failures were studied to determine the relation between fracture appearance and impact energy of steel from fractured ships. ***John A. Bennett.*** *U. S. Ship Structure Committee, SSC-113*, June 29, 1959, 9 pp. (VM1 Un3.7s Contin.)

717* Micromechanism of Brittle Fracture in a Low-Carbon Steel. Tensile data, elastic-limit measurements, and metallographic observations of slip, twinning and microcracks, as well as standard Charpy data, for a low-carbon steel in a coarse- and a fine-grained condition. ***G. T. Hahn, W. S. Owen, B. L. Averbach, and M. Cohen.*** *Welding Journal*, v. 38, Sept. 1959, p. 367s-376s.

718* Detecting and Preventing the Formation of Forging "Crossing" Cracks in High Speed Steels. Cracks occurring during production or detected in manufactured articles before and after thermal treatment are due to poor forging conditions, such as defective temperatures and heating time, and to flaws in the steel, due for instance to zonal, gaseous, and dendritic segregations. The surface conditions of the specimens should be controlled before and after the heat treatment. (*In Polish.*) Wykrywanie i zapobieganie powstawaniu krzvża kucia w wyrobach kutych ze stali szybkotnących. ***Marian Abramski.*** *Wiadomości Hutnicze*, v. 15, July-Aug. 1959, p. 238-245.

See also: **743** (tensile properties of Al-Ag alloy).

METALS—MECHANICAL WORKING

719 Underwater "Lightning" Sparks New Metal Forming Process. High-energy spark-discharge forms sheet-metal parts in 40-millionths of a second. Process is safe, predictable and capable of use in the shop. ***Rupert Le Grand.*** *American Machinist*, v. 103, Oct. 19, 1959, p. 123-124.

720 How to Minimize and Control Residual Machining Stresses. *Robert D. Halverstadt.* *American Machinist*, v. 103, Oct. 19, 1959, p. 137-144.

721* Strip Speed and Tension Regulation. *G. Varlas and A. J. Pasion.* *Automation*, v. 6, Sept. 1959, p. 58-62.

722 Automation in Production Engineering. A practical guide for machine tools and gaging equipment in machine shops. ***J. A. Oates.*** 326 pp. 1958. George Newnes Limited, London. (TJ1204 Oa8a)

723* Raising the Fatigue Strength by Means of Shot Peening. Presence of cold hardening at each deformation of the metal; geometrical stress distribution in the case of small pits caused by the impact of small balls. Shot peening has an improving effect on a great variety of surfaces, such as cog wheels, decarburized springs, induction hardened materials, and flame hardened specimens. (*In Dutch.*) Vermoeidheidsvastheid op te voeren door shot peening. ***J. Alexander.*** *Bedrijf en Techniek*, v. 14, Sept. 5, 1959, p. 617.

724* Factors Affecting the Efficiency of Resinoid-Bonded Diamond Wheels. II. *R. G. Weavind.* *Industrial Diamond Review*, v. 19, Aug. 1959, p. 146-153.

725 Boost Austenitic Strengths by New Use for Old Process. Difficult-to-work sizes of austenitic bar stock are hardened by rotorolling. Type 200 and 300 stainless steels can be furnished to a minimum yield strength of 100,000 psi. ***Martin Fleischmann.*** *Iron Age*, v. 184, no. 11, Sept. 10, 1959, p. 181-183.

726 Cold Extrusion Gets Precision Into Tubular Products. *R. A. Quadt.* *Iron Age*, v. 184, no. 11, Sept. 10, 1959, p. 186-187.

727 An Electrolytic Jet Machining Technique for the Production of Thin Foils of Steel. *P. M. Kelly and J. Nutting.* *Iron and Steel Institute, Journal*, v. 192, pt. 3, July 1959, p. 246-248.

728 Hydrogen and Segregates in Flaking. Theories of flake formation in large steel forgings. ***T. E. Scott and A. R. Troiano.*** *Journal of Metals*, v. 11, Sept. 1959, p. 619-622.

729* Interchangeability Increases Versatility of Carbide Dies. *Clyde E. Smith.* *Machinery, (New York)*, v. 66, no. 1, Sept. 1959, p. 132-134.

730 Formed Magnesium Parts Can Keep Rolled Strength. Rapid drawing at lower-than-normal temperatures prevents annealing. ***Willard G. Axtell.*** *Materials in Design Engineering*, v. 50, Sept. 1959, p. 92-93.

731* Machining Costs and Their Influence on Metal Cutting Practice. *Milton C. Shaw.* *Microtecnic (English Edition)*, v. 13, no. 3, June 1959, p. 103-112.

732* On the Behaviour of Ceramic Cutting Tools When Applied in Cutting Cast Iron. *J. L. Remmerswaal.* *Microtecnic (English Edition)*, v. 13, no. 3, June 1959, p. 126-132.

733* Research on the Causes of Machinability Divergences in Steels. *R. Weill.* *Microtecnic (English Edition)*, v. 13, no. 3, June 1959, p. 133-142.

734 The Machining of Ultra Strength Alloys. Machinability studies on martensitic low alloy, hot work die, precipitation hardening stainless, and austenitic stainless steels. ***John Marancbik, Jr., H. V. Gould, and P. R. Arzt.*** *Society of Automotive Engineers, Preprint* 43R, 1959, 40 pp.

735* Rolling of Metals and Alloys Used in Atomic Techniques. Construction peculiarities of rolling mills; establishments for rolling radioactive elements; production technology of Th and U plates; Mo treatment in inert atmosphere; production of parts of heat liberating elements by rolling of powders. (*In Russian.*) Prokatka metallov i splavov, primeniaemykh v atomnoĭ tekhnike. ***I. M. Pavlov, S. A. Golovanenko, and E. B. Lushchik.*** *Stal'*, v. 19, no. 8, 1959, p. 728-731.

736 Chip Forming. Describes first briefly all types of chip formers used in machining operations. From analysis of weak points of conventional formers a suggestion for a new spring-loaded former is derived. (*In Czech.*) Utváření třísky. ***M. Dlouhý.*** *Strojírenství*, v. 9, no. 8, Aug. 1959, p. 605-610.

737* Can You Afford Numerical Control? Although numerical control has resulted in significant savings on hundreds of machining operations, it is not always a sure-fire way to cut costs. Tool engineers must analyze each operation to find out where numerical control will pay. ***Myron S. Curtis.*** *Tool Engineer*, v. 43, no. 3, Sept. 1959, p. 79-81.

738* Comparison Tool Test Saves Time. A method for determining the minimum number of tests to obtain statistically-significant tool-comparison data. ***Roy Mennell.*** *Tool Engineer*, v. 43, no. 3, Sept. 1959, p. 121-124.

739* Resharpening Carbide Gun Drills. *Tool Engineer*, v. 43, no. 3, Sept. 1959, p. 125-127.

740 Development of Uranium Nitride-Stainless Steel Dispersion Fuel Elements. Fabrication of stainless steel-clad flat-plate fuel elements having a core of 28 w/o UN dispersed in an iron-18 w/o chromium-14 w/o nickel-2.5 w/o molybdenum matrix. ***Stan J. Paprocki, Donald L. Keller, George W. Cunningham, and Andrew K. Foulds, Jr.*** *U. S. Atomic Energy Commission, BMI*-1365, July 31, 1959, 19 pp. (UF767 U3b Contin.)

741 Development and Properties of Coextruded Zircaloy-Clad Uranium Fuel Elements With Integral End Seals. Prototype uranium fuel elements clad with Zircaloy and with integral end seals of Zircaloy were fabricated by the coextrusion process. Details are given of the breakdown of large diameter stock by primary extrusion for use as billet components, and the fabrication of long lengths of clad rod of 0.630-inch and 1.000-inch diameter is described. ***H. F. Sawyer.*** *U. S. Atomic Energy Commission, NMI*-4710, Nov. 6, 1958, 83 pp. (UF767 Un3.1nm Contin.)

METALS—METALLOGRAPHY, TRANSFORMATIONS, AND STRUCTURES

742* The Measurement of Grain Contiguity in Opaque Samples. Suggests that the degree of contiguity (or contact) between adjacent grains be described by three parameters

which can be rigorously determined from measurements on a random plane of polish. An expression is derived for the number of contacts per unit volume and it is shown that this quantity cannot, in general, be estimated from measurements on a random plane. ***J. W. Cahn and J .E. Hilliard.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 759-761.

743* A Study of the Recrystallization Kinetics and Tensile Properties of an Internally Oxidized Solid-Solution Aluminum-Silver Alloy. A very fine dispersion of Al_2O_3 is produced by internal oxidation of solid-solution alloy of 0.14% Al in Ag. The particle size of the Al_2O_3 is approximately 50 to 100Å in radius. The yield strength of the alloy is increased markedly by internal oxidation. A further increase in strength is produced by cold working the internally oxidized alloy. Recrystallization is retarded by the finely dispersed oxide particles, so that the strength increase resulting from cold work is retained on annealing at temperatures up to about 700 C. ***A. Gatti and R. L. Fullman.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 762-769.

744* Temperature Dependence of Grain Migration in High-Purity Lead Containing Small Additions of Tin. The temperature dependence of the rate of grain boundary migration was measured in bicrystals of zone-refined Pb containing from 20 to less than 1 ppm by weight of Sn. The apparent activation energy in the temperature range from 320 to 200 C is markedly dependent upon the solute Sn concentration and upon the orientation relationship of the grains adjacent to the grain boundary. The quantitative experimental observations are compared with the predictions of various theories of grain boundary migration. ***K. T. Aust and J. W. Rutter.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 820-831.

745* Preferred Orientation in Extruded Aluminum Rod. The preferred orientation developed in extruded Al rods was studied as a function of extrusion temperature, extrusion speed, and position in the rod. Duplex $<111> - <001>$ textures were developed for slow extrusion speeds at temperatures of 75 to 850 F and for fast extrusion speeds at temperatures of 75 to 450 F. The $<001>$ texture component was shown to be primarily due to recrystallization occurring during fabrication. At fast speeds and billet temperatures of 650 to 850 F, complete recrystallization occurred and $<115>$ or $<118>$ textures were found. ***C. J. McHargue, L. K. Jetter, and J. C. Ogle.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 831-837.

746* Stabilization of the Martensitic Transformation in Iron-Nickel Alloys. Although the C (or N) content may be very low in these alloys, it plays an important role in the stabilization phenomenon. In fact, if these interstitial elements are removed by moist-H treatment, no evidence of stabilization is found. In the presence of 0.007 wt. % C, the activation energy for the stabilization process is comparable to that for the diffusion of C (or N) in ferrite rather than in austenite. This suggests that the interstitial diffusion controlling the stabilization occurs within the martensitic embryos rather than in the matrix of the parent phase. ***John Woodilla, P. G. Winchell, and Morris Cohen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 849-854.

747* Effect of Neutron Irradiation on the Martensite Transformation in Iron-Nickel Alloys. Irradiation lowers the M_s temperature of the alloy, causes changes in the electrical and magnetic properties of the high-temperature phase which indicate either an acceleration of phase separation or a clustering of Ni, and enhances strain recovery on specimens partially transformed to martensite prior to irradiation. Possible mechanisms to account for the effects are discussed. ***L. F. Porter and G. J. Dienes.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 854-863.

748* The Effect of Vibrations on Ordering in CuAu. The effects of 5, 10, and 15 kc vibrations were investigated over a range of ordering temperatures of 280 to 360 C. A decrease in the rate of ordering was observed at all frequencies and ordering temperatures. ***H. C. Burghard, Jr. and Franz R. Brotzen.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society,* v. 215, no. 5, Oct. 1959, p. 863-868.

749* Preferred Orientation in Silicon Iron. The development of a preferred orientation of the (100) [001] or "Goss" type in cold reduced 3% silicon iron is shown to occur during final anealing by a process akin to secondary recrystallization. For secondary recrystallization to occur, normal grain growth of the primary structure must be restrained. It is suggested that this may be brought about by the presence of finely dispersed silicon nitride. Methods of measuring the perfection of this texture are discussed. ***P. N. Richards.*** *Australian Institute of Metals, Journal,* v. 4, no. 2, Aug. 1959, p. 114-123.

750 Effect of Aluminum, Silicon, and Chromium on Primary Structure of Low-Carbon Steel. ***O. D. Moldarskii and A. P. Pronov.*** *Henry Brutcher Translation No.* 4738, 7 pp. (From *Izv. Akad. Nauk SSSR, OTN, Met. i Topl.*, 1959, no. 2, p. 40-42.) Henry Brutcher, Altadena, Calif.

751 The Fe-Cr-Co-C Quaternary System. Establishment of some sections of the equilibrium diagram. ***D. Coutsouradis and L. Habraken.*** *Cobalt,* no. 4, Sept. 1959, p. 3-27.

752* Investigation of a Nickel-Chromium-Aluminum-Titanium Alloy Strained in the Hardened State. During the decomposition of this alloy within a certain range of temperature, an intermetallic phase with a face-centered cubic lattice precipitates. The parameter of the lattice of the intermetallic compound is larger than the basic solid solution. Plastic deformation accelerates the decomposition of the alloy. The presence of the α-phase in the strained alloy appears at a lower temperature than in the hardened alloy. *(In Russian.)* Issledovanie deformirovannogo v zakalennom sostoianii splava nikel'-khrom-aliuminii-titan. ***V. G. Chernyĭ.*** *Fizika Metallov i Metallovedenie,* v. 8, no. 2, Aug. 1959, p. 205-210.

753* Contribution to the Metallography of Zirconium and Titanium. To overcome the difficulties encountered when preparing and evaluating Zr sections, a new method of chemical polishing and etching using a solution of 45 cm^3 H_2O, 45 cm^3 concentrated HNO_3, and 8-10 cm^3 HF was developed. Ti specimens were polished and etched by a solution containing 60 cm^3 H_2O_2, 40 cm^3 H_2O and 8-10 cm^3 HF. *(In Czech.)* Příspěvek k metalografii zirkonia a titanu. ***František Plzák and Helena Hubáčková.*** *Hutnické Listy,* v. 14, no. 7, July 1959, p. 580-583.

754* The Solubility of Carbon in Molten Manganese in the Presence of Iron and Silicon. The solubility of C was calculated for the following systems: Mn-C, Mn-Fe-C, Mn-Si-C, and Mn-Fe-Si-C. The theory of regular solutions was found to be applicable to these systems. The curves obtained coincide with experience up to a 15% Si content in the alloys. Some of the mixing energies had the following values: Fe-Mn: Q_{12} equals 0; Fe-Si: Q_{12} equals −40,000 cal; Fe-C: Q_{14} equals −23,400 cal. *(In Russian.)* Rastvorimost' ugleroda v zhidkom margantse v prisutstvii zheleza i kremniia. ***B. P. Buryler.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia,* 1959, no. 6, June, p. 9-14.

755* Particularities of Phase Transformations in Different Melts of Chromium-Nickel Steel. The difference observed in the hardness and structure of specimens after isothermal treatment at temperatures between 450 and 650 C and at 700 C is caused by formation and displacement of the surface active impurity in the intrametallic boundaries. The interval of temperature between 450 and 650 C corresponds to the maximum development of reversible temper brittleness observed in the first melt, and practically disappears in the second. *(In Russian.)* Osobennosti fazovykh prevrashchenīĭ v raznykh plavkakh khromonikelevoĭ stali. ***S. M. Baranov and E. M. Lukhina.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Chernaia Metallurgiia,* 1959, no. 6, June, p. 75-80.

756* Influence of the Mode of Plastic Deformation on the Recrystallization After Strain Hardening of Imperfect Single Crystals of Uranium Produced by the $\beta \rightarrow \alpha$ Transformation. A new method for the preparation of perfect crys-

tals of U was developed. It is based on the stretching of imperfect crystals produced by the $\beta \rightarrow \alpha$ phase change, followed by an anneal at above α. Depending on the orientation of the original imperfect crystal, deformation takes place by slip, twinning, or deformation bands. In the case of deformation by twinning the growth of larger crystals is facilitated. *(In French.)* Influence du mode de déformation plastique sur la recristallisation après écrouissage de monocristaux imparfaits d'uranium obtenus par changement de phase $\beta \rightarrow \alpha$. ***D. Calais, P. Lacombe, and N. Simenel.*** *Revue de Métallurgie*, v. 56, Aug. 1959, p. 261-272.

757* Contribution to High Vacuum Differential Thermal Analysis Study of Uranium Alloys. A differential thermal analysis apparatus working under high vacuum enables determination of structural transformation temperatures of U, Al, Fe, Zr, and Mo alloys. This method is sensitive and peculiarly convenient for the detection of invariant equilibria in alloys; it permits kinetic studies of perlitic decompositions, even when they are sluggish. *(In French.)* Contribution a l'etude des alliages d' uranium par analyse thermique differentielle sous vide. ***J. Bellot, J. M. Henry, and G. Carbane.*** *Revue de Métallurgie*, v. 56, Aug. 1959, p. 301-306.

758 Structural Changes in Homogenous Solid-Solution Phases. Surveys recent information obtained in the field of atomic synthesis of solid solutions. Emphasis is put on the importance of short range order and dissociation in alloy technic, as is the case with brass, nickel, silver, manganin, etc., and to which such phenomena as structural cold hardening and K state owe their existence. *(In German.)* Über Zustandsänderungen in homogenen Mischkristallphasen. ***W. Köster.*** *Schweizer Archiv für Angewandte Wissenschaft und Technik*, v. 25, Aug. 1959, p. 263-272.

759 Dislocations in Metals. Reviews the nature of dislocations, ways of studying them with the electron microscope, and their effects on the properties of materials. Relationships between dislocations, grain boundaries, inclusions, and the structure and orientation of the metal lattice are best exhibited by a combination of electron microscopy and electron diffraction. The formation and properties of the two different types of dislocation (sliding, or inclined-plane displacements) are described. Some stages of the cold-rolled state of Cr-Ni steel and the return from the cold-worked state in pure Ni are studied. *(In German.)* Versetzungen in Metallen. ***W. Bollmann.*** *Schweizer Archiv für Angewandte Wissenschaft und Technik*, v. 25, Aug. 1959, p. 310-313.

760 Self-Diffusion in Gamma Uranium. The self-diffusion coefficient of U was measured at four temperatures in the γ phase. The data are fitted by an Arrhenius-type equation: $D = 2.33 \times 10^{-8}$ cm 2/sec exp (−28,500 cal per mol/RT), and agree well with previously reported results. ***S. J. Rothman, L. T. Lloyd, R. Weil, and A. L. Harkness.*** *U. S. Atomic Energy Commission*, ANL-5971, July 1959, 38 pp. (UF767 Un3.1an Contin.)

761* Brass-Like Phases With A3-Type Structure. The brass branch of the A3-structures consists of a number of subbranches. These are described and discussed in connection with the band model. *(In German.)* Über messingartige Phasen mit A3-verwandter Struktur. ***Walter Burkhardt and Konrad Schubert.*** *Zeitschrift für Metallkunde*, v. 50, Aug. 1959, p. 442-452.

762* The Effect of Additions on the Age-Hardening Process of Copper Beryllium Alloys. The age-hardening process in Cu alloys with 2% of Be and various additions was investigated by measurement of hardness and electric resistance. The influence of additions may be explained in connection with the formation of the tetragonal intermediate phase γ' during the precipitation process. *(In German.)* Der Einfluss von Zusätzen auf die Aushärtung von Kupfer-Beryllium-Legierungen. ***Hans Thomas and Ursula Wilke-Dörfurt.*** *Zeitschrift für Metallkunde*, v. 50, Aug. 1959, p. 466-472.

763* Carbonitrides of Columbium. Phases and phase-boundaries in the ternary system columbium-columbium carbide-columbium nitride were determined by chemical and X-ray methods. *(In German.)* Karbonitride des Niobs. ***Georg Brauer and Richard Lesser.*** *Zeitschrift für Metallkunde*, v. 50, Aug. 1959, p. 487-492.

See also: **318** (structure of metallic solutions and intermetallic compounds); **693** (ductility of $\beta - \alpha$ Ti alloy).

METALS—POWDER

764* Iron-Alumina Materials. Microstructures and some mechanical properties are presented. Alloys containing up to 16% Al_2O_3 by weight are ductile at all temperatures tested. The Fe-Al_2O_3 materials have a higher yield stress and improved creep resistance over that of pure Fe. ***Arno Gatti.*** *American Institute of Mining, Metallurgical, and Petroleum Engineers, Transactions, Metallurgical Society*, v. 215, no. 5, Oct. 1959, p. 753-755.

765 Thermodynamics of Titanium Diboride. ***A. N. Krestovnikov and M. S. Vendrikh.*** *Henry Brutcher Translation No.* 4673, 8 pp. (From *Izv. VUZ, Tsvet. Metall.*, 1959, no. 2, p. 54-57.) Henry Brutcher, Altadena, Calif.

766 Effect of Molybdenum, Chromium, and Aluminum on the [Transverse] Strength of Hard Metals Bonded With Nickel or Cobalt. Alloying the binder in WC-Co and WC-Ni hard metals substantially increases transverse strength at high temperatures at relatively low contents of these elements (3–7% Cr or Mo, 1-2% Al in the cement); further increase of these elements lowers strength at room and high teperatures. The effects of adding Mo, Cr, and Al increase with the total amount of cement. ***A. I. Baranov, K. A. Bystrova, T. A. Novikova, and V. F. Funke.*** *Henry Brutcher Translation No.* 4736, 9 pp. (From *Izv. Akad. Nauk SSSR, OTN, Met. i Topl.*, 1959, no. 2, p. 43-47.) Henry Brutcher, Altadena, Calif.

767 Recent Developments in Sintered Titanium Carbide Compositions. ***J. Wambold and John C. Redmond.*** Paper from "High Temperature Materials", p. 125-139, 1959. John Wiley & Sons, New York. (TN700 M56h)

768 Recent Advances in Infiltrated Titanium Carbides. ***Henry W. Lavendel and Claus G. Goetzel.*** Paper from "High Temperature Materials", p. 140-154, 1959. John Wiley & Sons, New York. (TN700 M56h)

769 Wettability and Microstructure Studies in Liquid-Phase Sintering. ***N. M. Parikh and Michael Humenik, Jr.*** Paper from "High Temperature Materials", p. 155-168, 1959. John Wiley & Sons, New York. (TN700 M56h)

770* Bending Strength of Sintered Carbides at Elevated Temperatures. The maximum of the bonding strength occurs at about 200 C. *(In Czech.)* Ohybová pevnost slinutých karbidů za vyšších teplot. ***M. Dlouhý.*** *Hutnické Listy*, v. 14, no. 8, Aug. 1959, p. 692-695.

771* Powder Metallurgy of Niobium. Pure Nb powder, with a grain size varying up to a few hundred microns, was used in testing the effect of pressing power on properties of blanks, the effect of sintering temperature and of sintering time on the properties of sintered bars pressed at various pressures, the deformation of sintered bars, and the properties of semiproducts. *(In German.)* Pulvermetallurgie des Niobs. ***Jiří Vacek.*** *Neue Hütte*, v. 4, Aug. 1959, p. 493-502.

772* Character and Causes of Volume Changes During the Sintering of Compacts Made of Iron-Copper- and Iron-Copper-Graphite-Powders. Influence of sintering temperature (950 to 1250 C), sintering time (30 to 480 min.), and particle size and compacting density on the changes in volume and length of compacts made of Fe-Cu and Fe-Cu-graphite powders with up to 20% Cu and O or 1% graphite. Interpretation of the process of volume change. Derivation of an equation for the volume change. *(In German.)* Erscheinungsbild und Ursachen von Volumenänderungen beim Sintern von Presslingen aus Eisen-Kupfer- und Eisen-Kupfer-Graphit- Pulvermischungen. ***Gerhard Bockstiegel.*** *Stahl und Eisen*, v. 17, no. 79, Aug. 20, 1959, p. 1187-1201.

773* Preparation of Iron Powder by Sublimation of Iron Amalgam. A high quality iron powder is obtained from iron amalgam which forms at mercury cathodes during electrolysis of acid solutions of iron salts. The iron powder is obtained in a continuous process; for sintering purposes it is superior to

electrolytic iron powder. *(In German.)* Gewinnung von Eisenpulver durch Schwelen von Eisenamalgam. ***Gerhard Jangg, Gotthard Csizi, and Hans Hohn.*** *Zeitschrift für Metallkunde*, v. 50, Aug. 1959, p. 460-465.

NONDESTRUCTIVE TESTING AND QUALITY CONTROL

774* Ultrasonics in Braze Inspection. Pulse-echo techniques, using a focused beam show braze integrity of thin stainless-sandwich; equipment gives immediate, permanent record of tests. ***Philip Geddes.*** *Aircraft and Missiles Manufacturing*, v. 2, Sept. 1959, p. 14-16.

775* Quality Control in Printing Inks. Discusses equipment which is used in the quality control. *American Ink Maker*, v. 37, Oct. 1959, p. 37-40.

776 X-Ray Teams With Better Welding for Sub-Miniature Electronic Tubes. *American Machinist*, v. 103, Oct. 5, 1959, p. 95.

777 Optics Check Thread Gages Faster. The gage laboratory at Aeroquip can now make direct measurements on thread gages, with the traditional three-wire method, to ten-thousandths and hundred-thousandths. ***Charles McArthur.*** *American Machinist*, v. 103, Oct. 5, 1959, p. 102.

778 Testing As-Rolled Steel Rounds for Cracks by a Magneto-Inductive Eddy-Current Method. Fundamentals and description of a phase-sensitive eddy-current method for crack detection in rolled steel rounds. Current amplitude as affecting the possibility of uncovering cracks. ***H. Knüppel, G. Wiethoff, and W. Juchhoff.*** *Henry Brutcher Translation No.* 4618, 22 pp. (From *Stahl und Eisen*, v. 79, no. 10, 1959, p. 711-718.) Henry Brutcher, Altadena, Calif.

779* Some Applications of X-Ray Diffraction Testing at Werkspoor. Two 114.6 mm diameter cameras were used for pictures of preparations containing Fe and Fe alloys with FeKα-radiation, or containing no Fe with CuKα-radiation, in detecting corrosion in overheater and boiler pipes, in quality control of quartz powder and colloidal graphite, in identifying the cause of damages in diesel motors and of surface impurities in aluminum cones. *(In Dutch.)* Enkele toepassingen van het Röntgendiffractie onedzoek bij Werkspoor. ***P. J. Gellings.*** *Metalen*, v. 14, no. 15, Aug. 15, 1959, p. 229-231.

780* Specific Applications of Ultrasonic Waves to Non-Destructive Testing. A study of the advantages of examining welds by means of ultrasounds instead of X-rays, and description of some specific applications of ultrasonic testing such as checking the depth of fatigue cracks, checking structural defects with the absorption method and examination of the adhesion of antifriction metal to the bearing support. *(In Italian.)* Applicazioni specifiche degli ultrasuoni al controllo non distruttivo. ***C. Bordoni.*** *Metallurgia Italiana*, v. 51, Aug. 1959, p. 324-332.

781* Ultrasonic Inspection of Light-Alloy Extruded Sections by a Semiautomatic Immersion Method. Characteristics and results of the direct coupling manual scanning, ultrasonic inspection of light-alloy extruded sections. Examples are given for the advantages of the immersion technique such as higher speed, minor wear of quartz transducers and automatic control of defects. An immersion apparatus is described. *(In Italian.)* Controllo ultrasonoscopico di estrusi di lega leggera con procedimento semiautomatico a immersione. ***M. Robba and C. Fatigati.*** *Metallurgia Italiana*, v. 51, Aug. 1959, p. 333-341.

782* Radiologic Control of Castings From the Organizational Point of View. Among typical requirements of mass production special consideration is given to the non-destructive control of castings, with particular reference to the X-ray control giving rise to organizational problems and calling for rational solutions in order to avoid technical and economical failures. *(In Italian.)* Controllo radiologico di getti sotto un aspetto organizzativo. ***R. Parigi.*** *Metallurgia Italiana*, v. 51, Aug. 1959, p. 349-352.

783* Non-Destructive Testing in Oil Refineries. Illustrates principles of operation, characteristics and possible applications of the instruments more frequently used in preventing corrosion in oil refineries. Such apparatus were described as ultrasound impulse equipment, γ ray and electromagnetic equipment. *(In Italian.)* Impiego in raffineria di apparecchi per controlli non distruttivi. ***G. Cibibin.*** *Metallurgia Italiana*, v. 51, Aug. 1959, p. 373-381.

784 Ductile Iron Quality Control. The principles of good design for quality castings apply to ductile Fe as well as to other metals, but deviation from these principles is more likely to cause trouble in ductile Fe than in gray Fe. Quality control methods ensure ductile Fe castings of consistent physical properties true to shape and good appearance. ***S. F. Levy.*** *Modern Castings*, v. 36, Oct. 1959, p. 38-41.

785* The Immersed Ultrasonic Inspection of Metal Plate. Describes work accomplished in the development of techniques for the ultrasonic inspection of metal plate in thicknesses down to ¼ in. The method of immersed ultrasonic inspection is briefly discussed. As the mechanical and electronic equipment is described, it is shown that automation could be accomplished easily. ***R. W. McClung.*** *Nondestructive Testing*, v. 17, no. 5, Sept.-Oct. 1959, p. 270-275.

786* Nondestructive Testing Handbook. A comprehensive and authoritative treatment of the basic technology of nondestructive testing. ***Robert C. McMaster, editor.*** v. I.-II. Sections individually paged. 1959. The Ronald Press Co., New York. (TA410 So13n Ref.)

787 Instrument Development at Savannah River. I. Nondestructive-Testing Equipment. This first article in the series on Savannah River instrumentation is confined to instruments used for pre-operational testing of reactor fuel and control components. Parts II and III will be concerned with reactor, fuel-processing and health-physics instrumentation. ***J. N. Wilson.*** *Nucleonics*, v. 17, Oct. 1959, p. 90 + 3 pages.

788* Radiographic Inspection Assures Flawless Steel Castings. *Western Metalworking*, v. 17, Sept. 1959, p. 43.

NUCLEAR PHYSICS, NUCLEONICS, AND RADIATION

789* Angular Correlation Between Neutrino and Gamma Quantum in *L*-Capture. The angular correlation between a longitudinally polarized neutrino and a circularly polarized γ-quantum released by an *L*-capture has been determined. The angular correlation was calculated for arbitrary γ-transitions and for captures forbidden in any order. ***K. Nagy.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 10, no. 2, 1959, p. 199-219.

790* Ionization Measurements in Photographic Emulsions. Discusses problem of finding proper parameters to express state of density of the point sequence as a function of loss of energy of particle producing the trace on the track. A new ionization parameter in direct and simple relationship with the specific ionization capacity and depending upon as few emulsion constants as possible was studied. *(In German.)* Ionisationsmessungen in photographischen Emulsionen. ***Marietta Blau.*** *Acta Physica Austriaca*, v. 12, no. 4, Aug. 1959, p. 336-355.

791 Isotopic Spin. After a short introduction the Pauli theory of mechanical spin is reviewed and then this formalism is used to develop the isotopic spin formalism along parallel lines. Some examples of the formalism's applications to β decay and nuclear reaction problems are given. ***J. P. Davidson.*** *American Journal of Physics*, v. 27, no. 7, Oct. 1959, p. 457-465.

792 Motion of Free Particles in Discontinuous Gravitational Fields. A new paradox occurring in the usual solution of the original "clock paradox" is given a natural physical interpretation by the observation that the mass of a particle moving in a gravitational field depends on the gravitational potential as well as on the velocity, thus changing abruptly

when a gravitational field is suddenly turned off. ***C. Moller.*** *American Journal of Physics*, v. 27, no. 7, Oct. 1959, p. 491-493.

793* Determination of the Nuclear Quadrupole Moments of the Radioactive Isotopes Cs^{135} and Cs^{137}. With the help of the double resonance method, high frequency transitions were detected in the hyperfine structure of the stimulated $7^2P_{3/2}$-term of the Cs I-spectrum. The measurements were taken on the O.2 mC specimen of a fission product containing about as much radioactive isotopes Cs^{135} and Cs^{137} as the stable pure isotope Cs^{133}. *(In German.)* Bestimmung der Kernquadrupolmomente der radioaktiven Isotopen Cs^{135} und Cs^{137}. ***H. Bucka, H. Kopfermann, and E. W. Otten.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 39-49.

794* Brehmstrahlung of a 31 Mev Betatron and of Some (γ, α) Reactions. A study of (γ, α) reactions on the average and heavy nuclei was made with the purpose of determining more precisely the emission spectra of the α-particles and eventually the effective sections, and comparing these results with the theory. *(In French.)* Le rayonnement de freinage d'un bétatron de 31 mev et quelques réactions (γ, α). ***Georges Boulègue.*** *Annales de Physique*, v. 4, ser. 13, no. 7-8, July-Aug. 1959, p. 813-863.

795* Optics of the Deviations of a Beam of High Energy Particles. Study of theoretical and practical problems arising in the deviation, analysis and refocusing of a beam of accelerated particles. Examination is made of certain of the solutions proposed, followed by methods of calculation established for this study, and of the various essential elements: electromagnets, four-pole lenses. *(In French.)* Optique des déviations d'un faisceau de particules de haute énergie. ***J. Pinel.*** *Annales de Radioélectricité*, v. 14, no. 57, July 1959, p. 230-249.

796* Charge Distributions of Nuclei of the 1*p* Shell. New data have been obtained at energies of 160 to 420 Mev for the scattering of electrons by Be^9, B^{10}, B^{11}, N^{14}, and O^{16}. It is possible to fix rather accurately the spherically symmetric part of the charge distributions of Li^6, C^{12}, N^{14}, and O^{16}, and with less accuracy, those of Be^9 and B^{11}. The quadrupole scattering depends sensitively on the source of the quadrupole moment, as well as on its value. Regularities within the *p*-shell are discussed, and connection made with the properties of heavier nuclei. ***Ulrich Meyer-Berkhout.*** *Annals of Physics*, v. 8, Sept. 1959, p. 119-171.

797* s- and p-Wave Neutron Spectroscopy. I. Peak Height Analysis and Level Assignments. Methods for analyzing transmission measurements of neutron resonances in the kev region are discussed. The "peak height" and the "double difference" methods are described in detail. To illustrate the methods of analysis, the spins and widths of several compound nucleus states in sodium and fluorine are determined from experimental data. ***E. Merzbacher, P. W. Crutchfield, Jr., and H. W. Newson.*** *Annals of Physics*, v. 8, Oct. 1959, p. 194-210.

798* s- and p-Wave Neutron Spectroscopy. III. Area Analysis of Neutron Resonances. A method of analysis is developed which accurately takes into account interference. It is shown that the importance of the interference effect in obtaining Γ or $g\Gamma n$ is determined not only by the size of the potential phase shift, but also by the sample thickness. Results of calculations are presented and it is shown that the errors inherent in the conventional methods of analysis due to the neglect of interference effect can become abnormally large in certain cases. ***Kamal K. Seth.*** *Annals of Physics*, v. 8, Oct. 1959, p. 223-249.

799* s- and p-Wave Neutron Spectroscopy. IV. Experimental Methods in the kev Region. A new high-resolution collimation-detection system has been developed for neutron total cross-section measurements in the kev region. Neutron energy spread is relatively constant over a wide range of neutron energies. The resolution is apparently limited at present by nonuniformity of the thin Li targets. The optimum resolution obtainable with a reasonable counting rate has been calculated. The total cross section for Bi^{209} has been measured from 10 to 136 kev. An estimate has been made of the neutron widths Γ_n by a new method. ***P. F. Nichols, E. G. Bilpuch, and H. W. Newson.*** *Annals of Physics*, v. 8, Oct. 1959, p. 250-265.

800* Statistical Time Moments and an Asymptotic Formula for the Time-Energy Distribution of Slowed-Down Neutrons. Derives first the exact time moments and the conditions for their existence. Assuming small energies we get, also for the negative moments, the approximate formulae earlier obtained by von Dardel and Walen. Derives an asymptotic formula, valid for large values of a variable x, which is the collision number multiplied by the time elapsed since the entering of the neutrons. For small neutron energies we obtain a formula. Then it is seen that, although these formulae are rather good approximations in the region, where the distribution function is large, they are correct only to the first order if expanded in powers of $1/x$. Results of numerical calculations for deuterium and C moderators based on a formula are given in a diagram. Also calculated is the second nonvanishing term of the expansion obtained for the distribution function by Olsson in the form of a power series in time. In order to estimate the rate of convergence, this term is then compared with the first nonvanishing term, which has been calculated by Olsson himself. Discusses time distribution functions for different energies. ***Karl-Erik Eriksson.*** *Arkiv för Fysik*, v. 16, no. 1, 1959, p. 1-14.

801 Advanced Reactor Concepts for Nuclear Propulsion. ***Frank E. Rom.*** *Astronautics*, v. 4, Oct. 1959, p. 20-22.

802 Gaseous-Core Nuclear Rockets. Conceivable in many forms, they seem at present mostly a field for speculation, but experiments in progress may bring them close to reality. ***Jerry Grey.*** *Astronautics*, v. 4, Oct. 1959, p. 23 + 4 pages.

803 Solid-Core Nuclear-Rocket Design. The state of the art of solid-core nuclear rockets took a big step forward recently with the successful testing of the Kiwi-A reactor at the AEC Nevada Proving Ground. ***Franklin P. Durham.*** *Astronautics*, v. 4, Oct. 1959, p. 26 + 4 pages.

804 Boundary Conditions for Nuclear Propulsion. No physical phenomena yet discovered will prevent development of nuclear rockets for exploring our whole solar system. ***Robert W. Bussard.*** *Astronautics*, v. 4, Oct. 1959, p. 28 + 5 pages.

805* The Fine Structure in the Fission Yield Curve for U^{233}. The yields of Ba^{138}, Sr^{88}, Sr^{90}, Y^{89} and of five Zr isotopes formed during the fission of U^{233} were measured. A thin structure indicating the relationship between the yield of small fragments and the mass number was discovered, and on the fission yield curve a boundary for the transfer from the light fragment emission of 1 neutron to the emission of 2 neutrons was determined. The structure is connected with the moment of fission. *(In Rusian.)* Tonkaia struktura krivoĭ vykhoda oskolkov deleniia U^{233}. ***V. K. Gorshkov and M. P. Anikina.*** *Atomnaia Energiia*, v. 7, no. 2, Aug. 1959, p. 144-147.

806* On the Design and Use of Strong Radiation Sources. Experimental investigation of the factor of accumulation in the region of the small distances from the point sources of the γ-rays Co^{60} and Cs^{137}. It was shown that for practical calculations (under barrier geometry conditions, with a comparatively low thickness of the absorbing layer) it was possible to use the data contained in the literature for a homogeneous infinite medium. *(In Russian.)* Nekotorye printsipy rascheta i ispol'zovaniia moshchnykh obluchateleĭ. ***A. V. Bibergal' M. M. Korotkov, and T. G. Ratner.*** *Atomnaia Energiia*, v. 7, no. 3, Sept. 1959, p. 244-251.

807* The Significance of the Particle Accelerator for Research and Technical Science. Numerous possibilities for application in basic research, especially in nuclear physics, but also in medicine, biology, and in the technical spheres of radiography, sterilization, radiation chemistry, production of neutron deficient radio-nuclides. *(In German.)* Die Bedeutung der Teilchenbeschleuniger für Forschung und Technik. ***W. Walcher.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 274-277.

808* Particle Acceleration and Thermonuclear Fusion. In certain types of experimental fusion apparatus (Ogra, DCX) particles are injected into the container using accelerators. *(In German.)* Teilchenbeschleunigung und thermonukleare Fu-

sionsreaktion. ***H. Neu.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 290-292.

809* The Heidelberg Cyclotron. The first to be built in Germany. In 1952 completely reconstructed for 12 MeV deuterons. Chamber with a one dee system. *(In German.)* Das Heidelberger Zyklotron. ***U. Schmidt-Rohr.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 293-296.

810* The Synchro-Cyclotron at Bonn University. In operation since mid-1958 for 31 MeV deuterons with newly developed modulator. Attentions for 65 MeV protons are planned. *(In German.)* Das Synchrozyklotron der Universität Bonn. ***Wolfgang Riezler.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 296-299.

811* Van de Graaff Accelerator for Research. As examples of larger installations in the Federal Republic: the 5.5 MeV equipment of Freiburg University and the planned tandem accelerator in the Max Planck Institute for Nuclear Physics in Heidelberg. *(In German.)* Van-de-Graaff-Beschleuniger für die Forschung. ***Gunter Busch.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 303-306.

812* High Frequency Installations for Particle Accelerators. Proton linear accelerators as examples of frequency stable HF systems and synchrocyclotrons of frequency modulated systems for generating the necessary HF energy for the desired acceleration and transferring it to the particles. *(In German.)* Hochfrequenz-Anlagen für Teilchenbeschleuniger. ***V. H. Schmitter.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 329-333.

813* The Plasma-Accelerator. In the Aachen plasma-betatron ignition and ionization are brought about by mixed electric and magnetic irradiation of a non-resonant high frequency field; in Bonn by high frequency quadripole fields in resonance with the transverse movement of the electrons in the torus. *(In German.)* Der Plasma-Beschleuniger. ***Martin Deutschmann.*** *Atomwirtschaft*, v. 4, nos. 7-8, July-Aug. 1959, p. 343-344.

814* The High Temperature Reactor of BCC/Krupp. This reactor provides for graphite spheres with a filling of 20% enriched U carbide as fuel elements and Th carbide as breeder material. A gas mixture of He and Ne is used for cooling. The steam generator produces superheated steam at 505 C and 75 atm pressure. Gives a detailed description of safety problems and the decontamination arrangements for the primary gas circulation. *(In German.)* Der Hochtemperaturreaktor von BBC/Krupp. ***R. Schulten, et al.*** *Atomwirtschaft*, v. 4, no. 9, Sept. 1959, p. 377-384.

815 Control for a Nuclear Test Reactor. Westinghouse Testing Reactor, Waltz Mill, Pennsylvania. ***F. L. Kelly.*** *Automatic Control*, v. 11, no. 3, Sept. 1959, p. 6-11.

816* Atomic Fuel. A survey was made of the U and Th sources, with an evaluation of the atomic fuel reserve in the world, and a description of the methods used in detecting minerals containing U and Th such as radioactive investigation, car prospection, detection from the air especially the "grid-flying", investigation on and in the ground, and of the extraction methods. *(In Dutch.)* Atoombrandstof. ***T. van der Klis.*** *Bedrijf en Techniek*, v. 14; *Electronica*, v. 12, Aug. 22, 1959, p. 133 + 4 pages.

817* The Effects on Materials by Nuclear Radiation. During nuclear fissions, approximately 10% of the liberated energy is released in the form of fission products, α- and β particles, gamma-rays and neutrons. Such materials as offer the highest resistance to these products are metals, ceramic substances, polysilanes, polyesters, phenol resins and epoxide phenol plastics. The substances rapidly attacked are fats, lubricants, hydraulic oils, natural and synthetic rubber and textiles. *(In German.)* Materialbeeinflussung durch Kernstrahlung. ***Gerald Reinsmith.*** *Bitumen, Teere, Asphalte, Peche*, v. 10, no. 8, Aug. 1959, p. 295-296.

818 Some Highlights of Experience and Engineering of High-Power Heavy-Water-Moderated Nuclear Reactors. James Clayton Lecture. ***W. B. Lewis.*** *Chartered Mechanical Engineer*, v. 6, no. 8, Oct. 1959, p. 384-394.

819* Effect of High Temperature and Nuclear Radiation on Silicone Insulation Systems. Presents and analyzes the results of an intensive evaluation program involving several silicone insulation systems in these categories: random-wound equipment (motorette samples); form-wound equipment (formette samples); wire and cable; complete machine (motor test). ***C. G. Currin and F. A. Smith.*** *Electrical Manufacturing*, v. 64, Oct. 1959, p. 110 + 6 pages.

820 Ohmic Heating Circuits for Plasma Physics. Audio generator heats stellarator plasmas to one million degrees C during thermonuclear fusion process. Experimental system produces 1.2 megavolt-amperes at 0 to 20 kc. ***Rodger L. Gamblin.*** *Electronics*, v. 32, no. 41, Oct. 9, 1959, p. 57-59.

821* Fuel Fabrication at Argonne National Laboratories. With the recent dedication of the fuel fabrication facility at the Argonne National Laboratory, Lemont, Illinois, an important milestone has been passed in the field of Pu application in the American Atomic Energy Program. The new facility was built by the U. S. Atomic Energy Commission at a cost of some 4,000,000 dollars and is devoted to the development of Pu fuel element fabrication techniques and the manufacture of such elements for various American reactors. The special hazards associated with Pu required the facility to be designed with various safety aspects, including extensive hood enclosures and a recirculating He atmosphere system. *Engineer*, v. 208, Aug. 28, 1959, p. 160-165.

822* Nuclear Reactors for Marine Propulsion. A preliminary design of a smaller reactor suitable for a 20,000 s.h.p. marine propulsion installation has recently been completed. Reductions in weight, size and capital cost result from improvements incorporated in the new design. *Engineer*, v. 208, Oct. 9, 1959, p. 380-383.

823* Symmetry Properties in the Elementary Particle and Nuclear Process Theory. Selection rules were obtained from the investigation of the symmetry properties of wave functions derived from the invariancy of the Lagrange operator and consequently from the motion equations in relation to homologous relations of the space coordinate axes and of the time axis. In considering such transformations, the types of particles possible with the spin in question were investigated. *(In German.)* Symmetrieeigenschaften in der Theorie der Elementarteilchen und Kernprozesse. ***I. S. Sapiro.*** *Fortschritte der Physik*, v. 7, nos. 4/5, 1959, p. 243-289.

824* Q-Multiplication for Increasing Nuclear Magnetic Resonance Signals. ***R. Chidambaram.*** *Indian Academy of Sciences, Proceedings*, v. 50, sec. A, no. 1, July 1959, p. 63-67.

825* A Note on the Interaction Between Nucleon and Anti-Nucleon. The interaction potential between nucleon and anti-nucleon is derived by using the new Tamm-Dancoff formalism. ***Alladi Ramakrishnan and N. R. Ranganathan.*** *Indian Academy of Sciences, Proceedings*, v. 50, sec. A, no. 2, Aug. 1959, p. 91-94.

826* A Study of the Multiple Scattering of the Coherent Optical Resonance Light. Application to the 6 $^3P_1$ Level of Mercury. III. Results of Experiments. The degree of polarization of the resonance light and the apparent lifetime ("coherence time") of the 6 $^3P_1$ level have been measured, in the case of selective excitation of an even isotope, or of one of the hyperfine levels of the odd isotopes, as functions of the number of atoms per c.c. which effectively scatter the radiation, for fixed geometrical conditions. Effects due to variation of geometrical conditions have also been studied. *(In French.)* Étude de la diffusion multiple cohérente de la lumière de résonance optique. Application au niveau 6 $^3P_1$ du mercure. III. Résultats Expérimentaux. ***J. P. Barrat.*** *Journal de Physique et le Radium*, v. 20, no. 7, July 1959, p. 657-668.

827 Neutron Diffraction Techniques and Their Applications to Some Problems in Physics. Neutron transmission and diffraction techniques are described with application to problems in nuclear physics, crystallography, magnetic scattering, physical structure of materials, and the liquid state. Experimental results for nuclear scattering amplitudes, positions of light atoms among heavy atoms, magnetic moment alignments in antiferromagnetic structures, and diffraction of neutrons by alkali metals in the liquid state are reported. The main features

of the design and operation of the neutron diffraction spectrometer and the auxiliary equipment are given. ***S. S. Sidhu, LeRoy Heaton, and M. H. Mueller.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1323-1340.

828* The Effects of Nuclear Radiation on Materials. Charged particles, gamma and neutron radiation are discussed. ***T. P. Flanagan.*** *Journal of Electronics and Control*, v. 6, no. 4, Apr. 1959, p. 337-346.

829 Measurement of Systematic Track Distortion in a Propane Bubble Chamber. A propane bubble chamber, 6 x 2 x 2 in., has been operated with both single-piston and multiple-bellows expansion systems, the systematic distortions caused by turbulent motions being measured and compared in the two cases. ***W. H. Evans, et al.*** *Journal of Scientific Instruments*, v. 36, Aug. 1959, p. 365-367.

830* Nuclear Propulsion Applied to Satellite Boosting. Basic mechanics of boost trajectories for satellite orbits, with emphasis on nuclear rockets. As payload increases, the nuclear powered mission shows advantages in take-off weight and thrust. ***Wallace A. Moser.*** *Mechanical Engineering*, v. 81, July 1959, p. 38-40.

831 Thermal Characteristics of Uranium Dioxide. By early 1961, the U.K.A.E.A. plans to build a reactor experiment known as A.G.R. In place of the Mg-clad U metal fuel elements of Calder Hall and the early commercial stations, uranium dioxide pellets will be enclosed in Be tubes. The thermal characteristics of uranium dioxide are considered. *Metal Industry*, v. 95, Aug. 28, 1959, p. 58 + 1 page.

832* Double Moderator Neutron Dosimeter. A moderated BF_3 detector was developed for measuring fast neutron dose, flux and average energy in the laboratory. This instrument, called the "double moderator" and consisting of a "fluxmeter" and a "dosimeter", was calibrated with monoergic neutrons from an accelerator and with neutrons from radioactive sources. Several applications are described. ***J. De Pangher.*** *Nuclear Instruments and Methods*, v. 5, Aug. 1959, p. 61-74.

833* A Proportional Counter for Low Level Counting With High Efficiency. The counting space is lined with quartz covered with a conducting layer; it is enclosed in a Cu cylinder at ground potential. The backgrounds are 1.33 and 0.9 cpm. The total volumes are 0.551 with efficient volumes of about 0.461. ***Hl. De Vries and M. Stuiver.*** *Nuclear Instruments and Methods*, v. 5, Aug. 1959, p. 111-114.

834* The Level Scheme of ^{136}Ba. Gamma radiation following the decay of ^{136}Cs was investigated using a scintillation spectrometer. Decay of ^{136}La was investigated. ***R. K. Girgis and R. Van Lieshout.*** *Nuclear Physics*, v. 12, no. 2, July 1959, p. 204-217.

835* Uniformly Spaced Control Elements in a Reactor: Theoretical Basis of Application of "Absorption Area" to Reactor Control Evaluation. A quantitative but simple theory of the control effect of a uniformly distributed set of thermal poison elements in a hydrogen-moderated bare reactor core has been developed. ***Lewi Tonks.*** *Nuclear Science and Engineering*, v. 6, Sept. 1959, p. 202-213.

836* Minimum Total Mass. The problem of designing a reactor with minimum total mass is posed. This problem is related to that of designing a reactor with minimum critical mass. ***J. Ernest Wilkins, Jr.*** *Nuclear Science and Engineering*, v. 6, Sept. 1959, p. 229-232.

837* Determination of Time Behavior of Neutron Density and of Reactivity on the Argonaut Reactor. Theoretical and experimental results of the time behavior of neutron density as a function of both positive and negative step changes in reactivity are presented. An analytically constructed thermal flux function obtained from results of reactivity measurements in the reactor is compared with the actual recorded flux from the reactor. ***W. R. Kimel, W. E. Carey, F. G. Prohammer, and G. C. Baldwin.*** *Nuclear Science and Engineering*, v. 6, Sept. 1959, p. 233-237.

838 A Comparison of Dosimetry Methods. Choosing the right dosimetry system for a particular situation requires a critical evaluation of available data. There is no substitute for complete familiarity with the characteristics of the dosimeter selected. Lack of familiarity can obliterate all the potential advantages of one system over another. A table is compiled from questionnaires sent to different experts. We cannot expect them all to use the same criteria for their answers. Thus I have undertaken a critical comparison. ***Paul Schall, Jr.*** *Nucleonics*, v. 17, Oct. 1959, p. 68-71.

839 Direct Determination of the Half-Lives of Nine Nuclides. ***J. Paul Cali and L. F. Lowe.*** *Nucleonics*, v. 17, Oct. 1959, p. 86 + 1 page.

840 The Reaction ^{7}Li$(\alpha\gamma)^{11}$B. The gamma rays following excitation by the ^{7}Li$(\alpha\gamma)^{11}$B reaction of levels in ^{11}B at 9.28 mev, 9·19 mev and 8·93 mev have been studied with sodium iodide scintillation counters and a scintillation pair spectrometer. The decay schemes of these levels have been elucidated and angular distributions of some of the γ rays have been measured. Assignments of spins and parities have been made for some of the levels. ***G. A. Jones, C. M. P. Johnson, and D. H. Wilkinson.*** *Philosophical Magazine*, v. 4, ser. 8, July 1959, p. 796-814.

841 The Interactions of π^--Mesons With Complex Nuclei in the Energy Range (100-800) MeV. I. The Interaction Lengths and Elastic Scattering of 88 MeV π^--Mesons in G5 Emulsion. A block of emulsion has been exposed to the 96 mev π^--meson beam of the Liverpool synchrotron and 92.5 m of track have been scanned in the region where the mean energy is 88 mev. With the optical model of the nucleus, the absorption coefficient is found to be $K = (4.0 \pm^{2.5}_{0.12}) \ 10^{12}\text{cm}^{-1}$, and the change in wave number is given by $k_1 = -(1.86 \pm 0.20) \ 10^{12}\text{cm}^{-1}$. ***J. E. Allen, et al.*** *Philosophical Magazine*, v. 4, ser. 8, July 1959, p. 858-867.

842 Single-Particle Energies in the Many-Fermion System. Examines the ground state of the many-fermion system, using perturbation theory, with particular attention to Brueckner's method. A study of the single-particle propagators in the ground state of the system sheds some light on the relation between the single-particle energies used, for example, in the optical model of nuclear reactions, and Brueckner's self-consistent energies. ***David J. Thouless.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1383-1390.

843 Experimental Determination of the Nonmagnetic Neutron-Electron Interaction. A precise set of measurements of the variation of the transmission of liquid Bi with energy in the range 0.1 ev to 10 ev has been made. After correction for neutron capture, Doppler effect and liquid diffraction, a value of $V_0 = -4.34 \pm 0.14$ kev is obtained as the depth of the potential well having a radius equal to the classical electron radius. This gives -0.26 ± 0.14 kev as the strength of the intrinsic neutron-electron interaction after subtraction of the Foldy term. ***E. Melkonian, B. M. Rustad, and W. W. Havens, Jr.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1571-1576.

844 Positive Pion Production in Proton-Proton Collisions at 450 Mev. The external proton beam of the Chicago cyclotron has been used to study the reaction $p + p \rightarrow \pi^+ + n + p$ at 450 Mev. The reaction $p + p \rightarrow \pi^0 + d$ was also measured as a check on the equipment. A double focusing wedge magnet was used to observe the momentum distribution of pions at angles of 14°, 20.5°, and 30° in the laboratory system. The over-all resolution of the magnet system varied from 1.5% to 2.2%. The spectra for the unbound reaction were fitted to *Ss*, *Sp*, *Ps*, and *Pp* spectrum shapes predicted by the phenomenological theory of pion production. The results show that $\sigma_{10}(Pp)$ is much smaller than has been previously reported. ***Lee G. Pondrom.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1623-1632.

845 Statistics of Slow-Neutron "Negative" Energy Resonances. Neutron cross sections measured with very slow neutrons often reveal the influence of levels below the neutron binding energy. The published data on 20 isotopes are analyzed in such a way that the properties of the levels below and above the binding energy may be compared. ***P. A. Egelstaff.*** *Physical Review*, v. 115, 2nd ser., no. 1, July 1, 1959, p. 182-184.

846 Classical Theory of Electronic and Ionic Inelastic Collisions. Shows that inelastic scattering, ionization, excitation, and other interactions between charged particles and atoms are due to the Coulomb interaction with atomic electrons and depend in a first approximation on their binding energy and momentum distribution. All cross sections can be calculated easily by means of differential cross sections $\sigma(\Delta E)$ and $\sigma(\Delta E,\delta)$ derived in the binary encounter approximation. ***Michal Gryziński.*** *Physical Review*, v. 115, 2nd ser., no. 2, July 15, 1959, p. 374-383.

847 Scattering of High-Energy Neutrons by He^4. Investigated for neutrons with energies of from 16 to 23.4 Mev with a He-filled ionization chamber. A pronounced resonance has been found at neutron energy of 22.15 ± 0.12 Mev. The neutron scattering experiments indicate that the level in He^5 has a width of about 100 kev which is much narrower than the ground state of He^5. ***T. W. Bonner, F. W. Prosser, Jr., and J. Slattery.*** *Physical Review*, v. 115, 2nd ser., no. 2, July 15, 1959, p. 398-400.

848* Ion Temperature in Scylla, as Determined From the Reaction D (*d,p*)T. ***D. E. Nagle, W. E. Quinn, W. B. Reisenfeld, and W. Leland.*** *Physical Review Letters*, v. 3, no. 7, Oct. 1, 1959, p. 318-320.

849* Fluctuations in Partial Radiation Widths. Attempt to clarify existing experimental evidence by performing a more extensive and refined set of measurements than those previously reported. ***L. M. Bollinger, R. E. Coté, and T. J. Kennett.*** *Physical Review Letters*, v. 3, no. 8, Oct. 15, 1959, p. 376-378.

850* Superfluidity of Nuclear Matter. A criterion for the superfluidity of infinite nuclear matter has been given in the form of a variational principle. Here is a report on computations which are an improvement over those in CMS in three regards; the effective mass approximation has been removed, more realistic two-body potentials have been employed, and superior trial functions have been obtained. ***R. L. Mills, A. M. Sessler, S. A. Moszkowski, and D. G. Shankland.*** *Physical Review Letters*, v. 3, no. 8, Oct. 15, 1959, p. 381-383.

851* Method for Producing Aligned Deuterons. ***M. E. Rose.*** *Physical Review Letters*, v. 3, no. 8, Oct. 15, 1959, p. 387.

852* Configurational Assignments of Giant Photonuclear Resonances. The electric dipole giant resonances of nuclear photodisintegration occur at an excitation of 15-20 Mev throughout the periodic table. They are associated, according to the independent-particle model (IPM) of the phenomenon, with the "one-quantum" excitations of the equivalent harmonic oscillator classification. Article points out that the configurational assignments made by the IPM for the giant resonance rest on rather general grounds and that the conclusion to be drawn from (*d,p*) gross structure results is not simple. ***D. H. Wilkinson.*** *Physical Review Letters*, v. 3, no. 8, Oct. 15, 1959, p. 388-389.

853* Charge Independence in Hyperon Production. ***Frank S. Crawford, et al.*** *Physical Review Letters*, v. 3, no. 8, Oct. 15, 1959, p. 394-396.

854 Neutral Pions. ***J. M. Cassels, D. P. Jones, P. G. Murphy, and P. L. O'Neill.*** *Physical Society, Proceedings*, v. 74, pt. 1, July 1959, p. 92-96.

855 An Investigation of the Protons, Deuterons and Tritons From the Bombardment of ^9Be With 5·7 MeV ^3He. A thin beryllium target has been bombarded by 5·7 MeV ^3He particles and the charged reaction products analyzed with a high precision broad-range magnetic spectrograph. Angular distributions of nine proton groups, four deuteron groups, and a single triton group have been measured. ***S. Hinds and R. Middleton.*** *Physical Society, Proceedings*, v. 74, pt. 2, Aug. 1959, p. 196-207.

856 Nuclear Optical Model. Discusses International Conference on the Nuclear Optical Model. ***Kenneth W. Ford.*** *Physics Today*, v. 12, Sept. 1959, p. 22-25.

857* Nuclear Power Plants Go Through Intensive Testing. Discusses modern trends in reactor design along with the testing of each reactor. *Power*, v. 103, Oct. 1959, p. 170-178.

858* The Hot Channel Concept of Water Cooled Reactors. The hot channel concept as applied to nuclear reactors has been a source of confusion to many interested in water cooled reactors. The author endeavors to clarify the meaning of such terms as peaking factors, burnout flux, and burnout safety factors. ***H. J. Rubinstein.*** *Power Engineering*, v. 63, Oct. 1959, p. 42-44.

859* And Now—The Anti-Lambda. Discusses the existence of this newly discovered particle. *Power Engineering*, v. 63, Oct. 1959, p. 47-48.

860* Power Reactor Technology. A review of recent developments. *Power Reactor Technology*, v. 2, no. 4, Sept. 1959, 85 pp.

861* The Worlds Largest Accelerator of Particles—Synchrophasotron. Description of a ten milliard electron-volts accelerator, connected with the 1959 Lenin's prize, constructed for the study of elementary particles and of their interactions. The future perspectives concerning the development of the accelerator technique was considered. (*In Russian.*) Krupneĭshiĭ v mire uskoritel' sinkhrofazotron. ***A. A. Kolomenskiĭ and M. S. Rabinovich.*** *Priroda*, v. 48, no. 8, Aug. 1959, p. 57-61.

862 Progress in Nuclear Energy. Series V. Metallurgy and Fuels. The solid state has been treated more fully, and special attention has been paid to all work on fuels and particularly to descriptions of the design and performance of these—so vital to the development of atomic energy. ***H. M. Finniston and J. P. Howe, editors.*** v. II. 653 pp. 1959. Pergamon Press, New York. (QC776 P94n)

863* Radiation Hygiene Handbook. A practical reference covering the industrial, medical, and research uses of radiation and atomic energy with special applications to the fields of health physics, industrial hygiene, and sanitary engineering. ***Hanson Blatz, editor.*** Sections individually paged. 1959. McGraw-Hill, New York. (RA1231.R2 R11 Ref.)

864* Energy Distributions of Ions Obtained From a High Frequency Source. The cylindrical capacitor method was applied to the study of the energy spectrum of ions derived from a high frequency source during capacitative and inductive discharge excitations. The ion spectrum obtained was compared with the function of distribution of ion energies, at high frequency discharges, without any pulling arrangement. (*In Russian.*) Raspredelenie po energiiam ionov izvlekaemykh iz vysokochastotnogo istochnika. ***E. T. Kucherenko and A. G. Fedorus.*** *Radiotekhnika i Elektronika*, v. 4, no. 8, Aug. 1959, p. 1233-1237.

865* Reactor Core Materials. A review of recent developments in solid materials for reactor cores. *Reactor Core Materials*, v. 2, no. 3, Aug. 1959, 55 pp.

866 Atomic Energy and Naval Propulsion in 1958 and Its Development Perspectives. ***J. P. Ricard.*** *U. S. Atomic Energy Commission, AEC-tr-*3739, Aug. 1959, 21 pp. (UF767 Un3.1ae Contin.)

867 The Radial Distribution of Thermal Neutron Flux in Cylindrical Fuel Specimens During Neutron Irradiation. Natural U and alloys of Mg-Cd were used in the investigation. The alloys were used to simulate the absorption properties of reactor fuel materials. Effects of the variable cylinder radius, a, and macroscopic absorption cross section, Σabs, in the range $0 < \omega < 2.2$, where $\omega = a\Sigma$abs, were studied. ***Frank R. Taraba and S. Hugh Paine.*** *U. S. Atomic Energy Commission, ANL-*5872, Aug. 1, 1959, 37 pp. (UF767 Un3.1an Contin.)

868 Argonne High-Flux Research Reactor—AHFR Conceptual Design Study. The program requires some irradiations in thermal neutron flux approaching 5 x 10^{15}n/(cm^2)(sec) and some beam experiments having over 10^{15}n/(cm^2)(sec) available. Parametric studies indicate that the highest peak thermal flux per unit of reactor power can be obtained in an internal H_2O reflector having a radius of about 6 cm. ***L. E. Link, et al.*** *U. S. Atomic Energy Commission, ANL-*5983, June 1959, 75 pp. (UF767 Un3.1an Contin.)

869 Preliminary Report on Conversion of Uranium Hexafluoride to Uranium Dioxide in a One-step Fluid-bed Process. Hydrogen and steam were used for simultaneous reduction

and pyrohydrolysis reactions carried out at 600 C, resulting in the formation of a dense coating of dioxide on the starting bed of uranium dioxide. The effects of uranium hexafluoride feed rate and reactant excesses on conversion were investigated. ***I. E. Knudsen, N. M. Levitz, and S. Lawroski.*** *U. S. Atomic Energy Commission, ANL*-6023, Aug. 1959, 14 pp. (UF767 Un3.1an Contin.)

870 Comparison of Bulk Shielding Reactor Centerline Measurements in Water With Predictions. Measurements of fast neutron and γ ray dose rates in water along the centerline of the Bulk Shielding Reactor(BSR) are compared with predictions made by use of three available computer programs. ***A. W. Casper.*** *U. S. Atomic Energy Commission, APEX*-504, Nov. 1958, 27 pp. (UF767 Un3.1ap Contin.)

871 Progress on the Development of Uranium Carbide-Type Fuels. Alternate fabrication techniques, melting and casting, properties of carbide materials, diffusion studies of uranium monocarbide, irradiation damage are discussed. ***Frank A. Rough and Walston Chubb, editors.*** *U. S. Atomic Energy Commission, BMI*-1370, Aug. 21, 1959, 14 pp. (UF767 U3b Contin.)

872 Polarization of Neutrons From the Reactions $Li^7(p,n)Be^7$ and $D(d,n)He^3$. Measured for the $Li^7(p,n)Be^7$ reaction at a laboratory angle of 50° for proton energies from 3.0 to 6.0 Mev, and for the $D(d,n)He^3$ reaction at a laboratory angle of 40° for deuteron energies from 2.0 to 4.5 Mev. Liquid He contained in a thin-walled dewar was used as a polarization analyzer. A millimicrosecond time-of-flight system was used as a neutron spectrometer. ***Joseph A. Baicker.*** *U. S. Atomic Energy Commission, CU*-183, Jan. 22, 1959, 70 pp. (UF767 Un3.1cu Contin.)

873 Neutron Resonances in U^{238}. The results of time-of-flight measurements of U^{238} resonances in the region 90-1300 e.v. are presented and resonance parameters for levels up to 1000 e.v. are obtained. Neutron widths for the 55 observed levels and radiation widths for 32 of the stronger levels are deduced. The average values of the radiation width, reduced neutron width, and level spacing are in agreement with the earlier, more uncertain values of other workers. ***Jerome Leonard Rosen.*** *U. S. Atomic Energy Commission, CU*-185, May 6, 1959, 71 pp. (UF767 Un3.1cu Contin.)

874 Moderating Ratios and Poisoning Ratios of the Elements and Some Compounds. Defines and explains moderating ratio and poisoning ratio and their significance. Best values of moderating ratio and (where applicable) poisoning ratio are given in tabular form, first for materials most likely to be used at the Portsmouth Gaseous Diffusion Plant, and then for all elements and some compounds. ***J. L. Feuerbacher.*** *U. S. Atomic Energy Commission, GAT*-T-673, Sept. 1, 1959, 11 pp. (UF767 Un3.1ga Contin.)

875 Nuclear Physics Research Quarterly Report, January, February, March 1959. Includes sections on reactor lattice physics, critical mass physics, and theoretical physics. ***John E. Faulkner, et al.*** *U. S. Atomic Energy Commission, HW*-60220, Apr. 20, 1959, 86 pp. (UF767 Un3.1hw Contin.)

876 The Effects of Low Neutron Exposures at Low Temperatures on the Hardness and Tensile Properties of Natural Uranium. Techniques for conducting low-exposure neutron irradiations of natural U at temperatures below 35 C are described. Tensile specimens were irradiated under these conditions to four exposure levels, the highest of which was 6.6 x 10^{17} nvt. Hardness and tensile tests were conducted. Irradiated specimens were annealed at 200, 300, and 400 C for 10 and 25 hours, following which hardness and tensile properties were measured to determine the extent of recovery. ***A. L. Bement.*** *U. S. Atomic Energy Commission, HW*-60326, June 2, 1959, 59 pp. + 1 plate. (UF767 Un3.1hw Contin.)

877 Operating Parameters and Neutron Flux Profiles for MTR Plutonium Core. A number of Pu fuel assemblies and shim rods were recently fabricated at the Hanford Works for operation in the MTR. Radiographs of the fuel plates revealed two types of faults. Using data obtained from a flux run, calculations showed that the reactor could be safely operated at 20 MW with an average shim rod position of 19 inches by using fuel assemblies in the center positions which have a fuel loading 20% less than the outside fuel. ***L. J. Harrison.*** *U. S. Atomic Energy Commission, IDO*-16526, July 31, 1959, 68 pp. (UF767 Un3.1id Contin.)

878 Critical Flow Velocities for Collapse of Reactor Parallel-Plate Fuel Assemblies. Theoretical formulas are presented. Considers both flat- and curved-plate assemblies and discusses the applicability of the formulas to design of reactor fuel-plate assemblies. *U. S. Atomic Energy Commission, KAPL*, 1954, Aug. 26, 1958, 25 pp. (UF767 Un3.1ka Contin.)

879 A Generalized and Consistent Method for Calculating the Critical Mass of Homogeneous Aqueous Uranyl Fluoride Solutions. A method of calculating the critical mass of aqueous uranyl fluoride solutions has been developed. Comparison of calculated results with experimentation gave a maximum of only 2.3% error in the effective multiplication factor and 9% error in the critical mass. ***O. W. Hermann.*** *U. S. Atomic Energy Commission, KY*-294, June 8, 1959, Sections individually paged. (UF767 Un3.1ky Contin.)

880 Half-Life of Radium-223. The half-life has been found to be 11.412 $\pm$ 0.014 days. This value is significantly lower than the currently accepted half-life (11.68 days), and definitely establishes that the latter is incorrect. However, because of certain discrepancies, the present half-life is not considered definitive and a slightly lower value is not excluded. ***H. W. Kirby, M. L. Curtis, and M. L. Salutsky.*** *U. S. Atomic Energy Commission, MLM*-1093, July 28, 1959, 12 pp. (UF767 Un3.1mL Contin.)

881 Fluidized Bed Reactor Study. I. Feasibility. In the present concept the fluid acts as a fluidizing, coolant and reactor moderator medium. This evaluation of the liquid fluidization process to reactor core design covers the materials, fluid flow and heat transfer, nuclear criticality and control, and the system and stability characteristics of the FBR concept. It was concluded that with proper system design, using light water or organic fluidizing mediums, the concept is feasible and offers considerable promise for economic power production. *U. S. Atomic Energy Commission, MND-FBR*-1696, Feb. 1959, Sections individually paged. (UF767 Un3.1mn Contin.)

882 OMR Control-Safety Rod Component Development Tests. A magnetic-jack control-safety rod is under development for the 45.5 thermal megawatt Organic Moderated Reactor. The rod is "unitized", i.e., the poison element, drive, position indicator, and shock absorber are contained in a compact assembly which is inserted in a regular fuel channel opening in the core. Since all components of the rod are immersed in the reactor coolant, they must operate at or above the reactor inlet temperature, 550 F. Tests to develop components capable of operating under these conditions are described and results are reported. ***J. D. Howell.*** *U. S. Atomic Energy Commission, NAA-SR*-3172, Sept. 15, 1959, 51 pp. (UF767 Un3.1na Contin.)

883 Annual Technical Progress Report AEC Unclassified Programs Fiscal Year 1959. Sections on sodium graphite reactors, Hallam nuclear power facilities, organic moderated reactor, Piqua research and development, kinetic experiment on water boilers, separations chemistry, and advanced development program. *U. S. Atomic Energy Commission, NAA-SR*-3850, Aug. 1, 1959, Sections individually paged. (UF767 Un3.1na Contin.)

884 Maritime Organic Moderated and Cooled Reactor. Describes the results of a six-week conceptual design study of an organic moderated and cooled reactor (OMCR) power plant adapted to a Class T-7 tanker. It has been prepared for the Maritime Reactors Branch of the Atomic Energy Commission by Atomics International, a division of North American Aviation, Inc. *U. S. Atomic Energy Commission, NAA-SR*-3859, May 27, 1959, Sections individually paged. (UF767 Un3.1na Contin.)

885 Sodium Reactor Experiment Fuel Irradiation Experience. Nondestructive examinations of the unalloyed U fuel in the Sodium Reactor Experiment (SRE) showed no increase in cladding diameter after 850 Mwd/Tonne calculated maximum burnup. Some clad stretching is evident at 950 Mwd/Tonne. Destructive examinations at maximum burnups of 65, 105, 390, and 850 Mwd/Tonne showed progressive irradiation-induced dimensional changes. Fuel element cladding examina-

tions indicated no apparent change in ductility after exposure to surface temperatures of about 850 F, with subsequent cycling resulting from startup and shutdown of the reactor. ***J. L. Ballif, B. R. Hayward, J. H. Walter, and C. C. Woolsey.*** *U. S. Atomic Energy Commission, NAA-SR-3887,* 31 pp. (UF767 Un3.1na Contin.)

886 Sodium Graphite Reactor Materials Survey. Reviews the general reactor concept and specific materials used for major reactor components: (1) shielding materials, (2) core materials, (3) sodium cooling system materials. In each case, the materials problems and the materials used to minimize or eliminate these problems are described. ***B. R. Hayward.*** *U. S. Atomic Energy Commission, NAA-SR-4013,* 41 pp. (UF767 Un3.1na Contin.)

887 Evaluation of the Moving Bed Reactor Process for the Production of Uranium Tetrafluoride-Termination Report. Comparison of the operating and investment costs for this design with those for a previously designed plant indicates that the moving bed reactor process remains economically feasible. Technical problems meriting further investigation are enumerated. ***Donald J. Loudin.*** *U. S. Atomic Energy Commission, NLCO-722,* Feb. 12, 1958 (Issued Sept. 15, 1959), 92 pp. (UF767 Un3.1nL Contin.)

888 Proceedings of the Neutron Thermalization Conference, April 28-30, 1958, Gatlinburg, Tennessee, Sponsored by Advisory Committee on Reactor Physics and Oak Ridge National Laboratory. Section on the epithermal range, thermal range, crystalline effects, and low energy spectra in heterogeneous media. *U. S. Atomic Energy Commission, ORNL-2739,* Sept. 2, 1959, Sections individually paged. (UF767 U3o Contin.)

889 Gas-Cooled Reactor Project Semiannual Progress Report for Period Ending June 30, 1959. Includes sections on design investigations and materials research. *U. S. Atomic Energy Commission, ORNL-2767,* Aug. 21, 1959, 215 pp. (UF767 U3o Contin.)

890 The Fast-Neutron Multiplication Effect of Beryllium in Reactors. Review of the available information on this effect and on the relevant cross section data is given. Based on this information an upper and a lower estimate of the (n,2n) cross section is given. The whole angular distribution of the elastically scattered neutrons is taken into account. Attention is given to the poisoning effect which is created by the daughter products of the (n,α) reaction. ***W. Häfele.*** *U. S. Atomic Energy Commission, ORNL-2779,* Sept. 22, 1959, 35 pp. (UF767 U3o Contin.)

891 An Exploding Wire as a Fuse for the LASL Capacitor Bank—Zeus. The fuse allows the passage of the high normal duty "action" (13,700 ampere-coulombs per capacitor) at a 20-second repetition rate. However, it interrupts the circuit to a shorted capacitor in 12 microseconds, thereby protecting the faulted capacitor from explosive energy consumption. The initial phase of the development included observations of various metals (Cu, Ag, Fe and Ni) as well as various configurations (straight wires, helixes, foils, and tubes). ***Eugene C. Cnare.*** *U. S. Atomic Energy Commission, SC-4324(TR),* June 4, 1959, 30 pp. (UF767 Un3.1sc Contin.)

892 D_2O-Moderated Power Reactors. A Symposium Held at the Atomic Energy Commission Headquarters Building, Germantown, Maryland, March 3-4, 1959. *U. S. Atomic Energy Commission, TID-7575,* Aug. 1959, 156 pp. (UF767 Un3ti Contin.)

893 Critical Measurements on Near-Homogeneous BeO-Moderated, Oralloy-Fueled Systems. Fuel density is varied by use of different foil thicknesses and spacings between foils. Five fuel densities have been used which correspond to atomic BeO/U^{235} ratios from 246 to 7660. For three of these ratios, the fuel foil thickness was varied to find effects of self-shielding and flux depression. ***Fred A. Kloverstrom, Richard M. R. Deck, and Arnold J. Reyenga.*** *U. S. Atomic Energy Commission, UCRL-5369* (pt. 1), July 1, 1959, 12 pp. (UF767 U3u Contin.)

894 Hot Box. A High-Temperature Critical Facility. The purpose of Hot Box is the measurement of the behavior of enriched reactors at elevated temperatures which will allow the normalization of existing calculational techniques and allow a better understanding of neutron behavior at and near thermal energies. ***Harry L. Reynolds and Carl E. Walter.*** *U. S. Atomic Energy Commission, UCRL-5483,* Mar. 30, 1959, 123 pp. (UF767 U3u Contin.)

895 Nuclear Spin and Hyperfine-Structure Measurements on the Radioactive-Iodine and Astatine Isotopes. Atomic-beam magnetic-resonance techniques have been used to measure the nuclear spins of these isotopes. In addition, the magnetic-dipole interaction constant, a, and the electric-quadrupole interaction constant, b, for I^{131} and I^{129} were found. ***Hugh Leslie Garvin.*** *U. S. Atomic Energy Commission, UCRL-8860,* Aug. 7, 1959, 115 pp. (UF767 U3u Contin.)

896 Reactor and Plant Engineering. *U. S. Atomic Energy Commission, WAPD-BT-14,* July 1959, 160 pp. (UF767 Un3.1wb Contin.)

897* The Theory of the Excitons in Crystals. A thorough study of the present state of the exciton theory with special consideration of its quantum mechanic basis, and covering the localized excitons and the non-localized excitons in the non-deformed and deformed lattice. *(In Russian.)* Teoriia eksitonov v kristallakh. ***G. Khaken.*** *Uspekhi Fizicheskikh Nauk,* v. 68, no. 4, Aug. 1959, p. 565-619.

898* Vacuum Techniques and Components Used for a Continuously Pumped Linear Electron Accelerator. A vacuum system has been designed to have an internal volume of approximately 30 *l*, and to produce vacuums down to 1×10^{-8} or better. The construction avoids all organic materials and is capable of being baked out at 450 C; design details of flanges, envelope construction, insulators and valves are discussed. Performance of the diffusion pump traps, which require no refrigeration, and their construction are described. ***R. C. Marker.*** *Vacuum,* v. 9, no. 2, May 1959, p. 128-133.

899* On Direct Formation of Electron-Positron Pairs by High Energy Electrons. The absolute number of spurious tridents due to 10^{10}, 10^{11} and 10^{12} eV primary electrons is computed by the Monte Carlo method for two types of bremsstrahlung spectrum: for that described by the Bethe-Heitler formula and that described by the Migdal formulas which take into account the Landau-Pomeranchuk and Ter-Mikaelyan effects. It is possible to measure the energy of fast electrons by determining the energy dependence of the mean transverse distance between the vertexes of electron-positron pairs produced by bremsstrahlung γ-quanta. *(In Russian.)* K voprosu o neposredstvennom obrazovanii elektronno-pozitronnykh par elektronami vysokoĭ energii. ***V. A. Tumanian, G. S. Stoliarova, and A. P. Mishakova.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 37, no. 2, Aug. 1959, p. 355-365.

900* Investigation of the Spectrum of Photoprotons Produced by γ-Quanta With Energies Lying in the Narrow Interval From 82 to 89 MeV. Energy spectra were investigated for protons ejected from C^{12} and Al^{27} by γ-quanta from bremsstrahlung spectra possessing peak energies of 82 and 89 MeV. The experimental data are compared with the curves computed on the basis of Dedrick's data. Although the agreement is not very good, it may nevertheless be possible that there is a contribution of a quasideuteron mechanism to the interaction between the γ-quanta and indicated nuclei. *(In Russian.)* Issledovanie spektrov fotoprotonov, obrazovannykh γ-kvantami uzkogo intervala energiĭ 82-89 Mev. ***E. B. Bazhanov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 37, no. 2, Aug. 1959, p. 374-379.

901* Ionic Oscillations in a Plasma. The effect of a high frequency electromagnetic field on ionic oscillations in a plasma is considered. It is shown that the frequencies of the longitudinal quasiacoustic oscillations of the plasma begin to depend on the amplitude of the field. Possible mechanisms of appearance of instabilities are discussed. *(In Russian.)* O ionnykh kolebaniiakh v plazme. ***T. F. Volkov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki,* v. 37, no. 2, Aug. 1959, p. 422-426.

See also: **101** (properties of nuclear reaction wastes); **582** (nuclear marine propulsion); **740** (dispersion fuel elements); **741** (zircaloy-clad U fuel elements).

OPERATIONS RESEARCH AND MANAGEMENT ENGINEERING

902 What's the Score Now With Psychological Tests? Supports the use of psychological testing to select and promote employees, which has come under a good deal of fire recently. ***Lyle M. Spencer.*** *American Business*, v. 29, Oct. 1959, p. 7-10.

903 The Art of Administration. II. ***Ray E. Brown.*** *American Business*, v. 29, Oct. 1959, p. 21-24.

904 Achieving Executive Management Growth. ***Robley D. Stevens.*** *American Paint Journal*, v. 44, Oct. 12, 1959, p. 50 + 3 pages.

905* Top Management Takes a Second Look at Electronic Data Processing. Electronic data processing costs are very high and the ramifications are considerable: Top management itself must now take an active interest in EDP. This concern should be about the fundamentals of EDP from the standpoint of management. ***Harold Koontz.*** *Business Horizons*, v. 2 ,no. 1, Spring 1959, p. 74-84.

906 Latest Fad Among the Brass: Find the Corporate Image. Discusses the "corporate image" concept of public relations. *Business Week*, no. 1570, Oct. 3, 1959, p. 64 + 4 pages.

907 The Decision Makers. Case Histories of Successful Management. Offers the professional manager—and the would-be professional manager—a practical, instructive and humanly interesting insight into the methods that other professional managers have used to solve problems and make their companies more profitable. This compilation relates the stories of 16 men whose initiative, ingenuity, and aggressiveness have made them outstanding in their respective industrial fields. ***R. R. Conarroe, editor.*** 180 pp. 1958. The Riverside Press, Cambridge. (HD31 M31d Over.)

908* Time Study and Methods Training for Supervisors. The need for supervisor education in time study and methods is discussed. A suggested program lasting for six or seven meetings is given. ***John Taylor.*** *Modern Castings*, v. 36, Sept. 1959, p. 59-60.

909* Putting Learning Curves to Work. An understanding of learning curves makes it possible to accurately forecast the production time for assembly work and other operations where efficiency is dependent on operator skill. Thus future schedules can be determined on a realistic basis and piece costs can be estimated with greater accuracy. ***Lou Wertman.*** *Tool Engineer*, v. 43, no. 3, Sept. 1959, p .99-102.

910* Control Charts—Key to Efficiency. Careful timing is essential to meet production deadlines. Simple charts provide the best means of highlighting planned objectives and making sure that those objectives are achieved on the production floor at the proper time. ***James H. Greene.*** *Tool Engineer*, v. 43, no. 3, Sept. 1959, p. 103-105.

911 Working Union-Management Relations. The Sociology of Industrial Relations. Represents a new evaluation of the state of affairs in the study of relations between companies and unions. Written from a sociological standpoint, special emphasis is given to the application of organization theory. ***Robert Dubin.*** **291 pp. 1958. Prentice-Hall, Englewood Cliffs, New Jersey. (HD6961 D85w)**

See also: **591** (publication decisions and tests of significance).

ORE AND MATERIALS BENEFICIATION

912 Reactions in Pelletizing and Iron Ore Reduction. I. Iron oxides: equilibrium conditions and lattice relationships. Oxidation of magnetic concentrate pellets. Parabolic law for a sphere, applied to oxidation of pellets. ***J. O. Edström.*** *Henry Brutcher Translation No.* 4559, 39 pp. (From *Jernkontorets Annaler*, v. 142, no. 7, 1958, p. 401-428.) Henry Brutcher, Altadena, Calif.

913* Mechanism and Kinetics of Reduction of Iron Oxides. Reduction of pure sintered Fe_2O_3 and natural polycrystalline magnetite by $CO + CO_2$ in the presence of C was investigated by measuring the relation: reduction degree/time. During the reduction the composition and quantity of the gases were recorded. The structure of the individual reduced layers was determined by X-ray phase analysis. *(In Polish.)* Mechanizm i kinetyka redukcji tlenków żelaza. ***Emilian Iwanciw.*** *Archiwum Hutnictwa* (Polish), v. 4, no. 2, 1959, p. 133-159 + 2 plates.

914 Variation of Hydraulic Resistance of Sinter Bed During Sintering Process. Distribution of temperature and suction in beds of fluxed and unfluxed sinters. New method of calculating the hydraulic resistance of beds during sintering. ***G. V. Ksendzyk.*** *Henry Brutcher Translation No.* 4632, 16 pp. (From *Izvestiya Vysshikh Uchebnykh Zavedenii* (VUZ), *Chern. Met.*, 1958, no. 7, July, p. 3-16.) Henry Brutcher, Altadena, Calif.

915 Magnetic Characteristics of Sinter as Function of Its Ferrous Oxide Content. Experimental study of a generally valid relationship between the ferrous oxide content of iron-ore sinters and their magnetic properties. ***N. A. Gladkov, Z. I. Nekrasov, and V. V. Chekin.*** *Henry Brutcher Translation No.* 4752, 11 pp. (From *Izv. Akad. Nauk SSSR, Otd. Tekh. Nauk, Met. i Topl.*, 1959, no. 2, p. 86-89.) Henry Brutcher, Altadena, Calif.

916 Briquetting in the Beneficiation of Fine Coal. A general review with a description of Nova Scotian practices. ***E. Swartzman.*** *Canadian Mining and Metallurgical Bulletin*, v. 52, no. 569, Sept. 1959, p. 564-571.

917* The Development of Plutonium Separation Processes. A summary of available processes. ***F. R. Paulsen.*** *Chemical & Process Engineering*, v. 40, Aug. 1959, p. 271-273.

918 New Pilot Processing Plant Designed for Heat Treating and Agglomeration. ***W. A. Shockley.*** *Engineering and Mining Journal*, v. 160, Sept. 1959, p. 98-101.

919 Treating Blind River Uranium Ores by Leaching Ion Exchange Precipitation. Techniques used in the seven mills of Rio Tinto Mining Co. of Canada are described. ***R. P. Ehrlich, A. G. Roach, and K. D. Hester.*** *Journal of Metals*, v. 11, Sept. 1959, p. 628-633.

920* Soap Flotation of Vermiculite. Effect of addition of Ba, Ca, and Mg salts on the lower and upper critical *p*H values for flotation with different size fractions; linoleic acid is a better collector than oleic acid for flotation of vermiculite. ***N. R. Srinivasan and R. K. Rama Murthy.*** *Journal of Scientific & Industrial Research*, v. 18B, Aug. 1959, p. 341-344.

921 Effects of Structure and Unsaturation of Collector on Soap Flotation of Iron Ores. ***Strathmore R. B. Cooke, Iwao Iwasaki, and Hyung Sup Choi.*** *Mining Engineering*, v. 11; *American Institute of Mining and Metallurgical Engineers, Transactions*, v. 214, Sept. 1959, p. 920-927.

922* Flotation-Cyanide Methods Overhauled at Iron King. Three changes in the treatment of Shattuck Denn Mining Company's sulphide ore of Pb-Zn-Au-Ag-Cu have contributed to better metallurgy at the 1,000 ton-per-day mill near Prescott, Arizona. They include: the use of stronger promoters for Au within the Pb flotation circuit and the use of more selective reagents for Zn flotation, addition of a regrind circuit to the Pb flotation section, and a change in cyanide treatment from the processing of final Zn flotation. *Mining World*, v. 21, no. 11, Oct. 1959, p. 24-27.

923* Beneficiation by Calcination of Phosphate Carbonate Ores. Consists of three phases: pre-treatment for eliminating some of the carbonate and clayey elements, calcination for decomposition of the carbonates, and after-treatment for maximum obtainable reduction in the ratio of CaO/P_2O_5. *(In French.)* Enrichissement par calcination des minerais de phosphate carbonatés. ***M. J. Masson.*** *Revue de l'Industrie Minérale*, v. 41, no. 8, Aug. 1959, p. 651-661.

924* Copper Ore Beneficiation at the Akjoujt Mine in Mauritania. Conventional methods are used. Flotation yields a concentrate of 27% Cu. After flotation, magnetic separation

gives a very high grade magnetite concentrate of more than 70% Fe and 0.08% Cu. *(In French.)* L'enrichissement des minerais de cuivre de la mine d'Akjoujt en Mauritanie. ***M. Rey.*** *Revue de l'Industrie Minérale*, v. 41, no. 8, Aug. 1959, p. 667-669.

925* Determination of Air Consumption in Flotation of Ores. Some devices for intermittent measuring of air amounts used per unit area of a flotation cell do not give uniform results. The new method and device permit a continuous measurement of air flow through the slurry and the diagrams allow a rapid reading of results. *(In Polish.)* Oznaczanie ilości powietrza w procesie flotowania rud. ***Emil Ryszka and H. Gogoliński.*** *Rudy i Metale Niezelazne*, v. 4, no. 1, Jan.-Mar. 1959, p. 10-13.

926 Physical Beneficiation of Low-Grade Uranium Ores. Methods of beneficiation investigated include flotation, wet and dry attritioning, magnetic separation, electrostatic separation, and miscellaneous minor methods. A rapid, routine method of colorimetric determination of U was also developed in order to facilitate analysis of low-grade materials. ***John N. Butler.*** *U. S. Atomic Energy Commission, RMO*-2683, July 30, 1958, 134 pp. (UF767 U3r Contin.)

PHYSICS

927 Absorption and Dispersion of Ultrasonic Waves. A textbook principally interested in the information which ultrasonics can give on certain molecular processes in liquids and gases, namely, on relaxation mechanisms associated with the rate of energy exchange and the rate of structural changes in the fluid. ***Karl F. Herzfeld and Theodore A. Litovitz.*** 535 pp. 1959. Academic Press, New York. (QC244 H44a)

928 Random Sound Field in Reverberation Chambers. A series of experiments were performed to compare the efficiency of different diffusing devices in producing a completely random sound field in a reverberation chamber and the effectiveness of some of the methods for judging whether a sound field is completely random. An additional experiment was performed to compare two types of test signals, *viz.*, warble tone and the same nominal band width of random noise. ***C. G. Balachandran.*** *Acoustical Society of America, Journal*, v. 31, Oct. 1959, p. 1319-1321.

929* Investigation of Concentration Distribution Around Crystals in Aqueous Solutions. Concentration distribution around growing and dissolving crystals is measured by a phase contrast method. The measurements indicate the existence of a boundary layer around the crystals, as discussed previously by Gyulai. ***G. Domokos and L. Malicskó.*** *Acta Physica Academiae Scientiarum Hungaricae*, v. 10, no. 2, 1959, p. 185-193.

930* A Contribution to the Study of the Thermoluminescence of Rare Earths in CaF_2. Investigations of the curves of thermoluminescence of synthetic CaF_2, activated with rare earths or Mn, showed that the shape of the glow curves is specific for the activator, that the traps for the holes, as regards their properties, must be determined by the mother crystal and that probably only their numerical distribution depends upon the activator. *(In German.)* Zur Thermolumineszenz der Seltenen Erden in CaF_2. ***Hans Adler.*** *Acta Physica Austriaca*, v. 12, no. 4, Aug. 1959, p. 356-399.

931* A Method for Measuring the Mobility of Ions in Dielectric Liquids. Method is based on the measurement of time of arrival at the electrodes of a layer of ions produced by X-rays in a flat ionization chamber filled with the liquid under investigation. The velocity of the ions is determined from the measurement of the difference in times of arrival of the ions at the respective electrodes for two different initial positions of the ionized layer. The measured values of the mobility of the positive and negative ions in hexane are 4.1×10^{-4} cm^2/V sec and $1.3 \times 10^{-3} cm^2/V$ sec. respectively. ***Olgierd Gzowski and Józef Terlecki.*** *Acta Physica Polonica*, v. 18, no. 3, 1959, p. 191-198.

932* Spin Waves in Various Ferrimagnetic Superstructures. I. Translation Lattices With Two Kinds of Spins. By means of a semiclassical approach the general dispersion formula for spin waves frequency is derived, taking into account interactions with all neighbors in any regular spin order of translation lattice with two kind of spins and comprising also ferromagnetism and antiferromagnetism. In the special cases the derived formula agrees entirely with those of other papers, based on semiclassical theory. The kinematical method of Keffer, Kaplan, and Yafet is generalized and equivalence with formal calculations is shown. ***Henryk Cofta.*** *Acta Physica Polonica*, v. 18, no. 3, 1959, p. 215-229.

933* Efficiency, Stability, and Characteristics of Photosensitive G. M. Counters. Describes stable photosensitive counters constructed from metal with a cathode in the form of a strip set into the counter tube. The method used to measure the photoelectric efficiency is based on the known spectral distribution of an ultraviolet standard and the transmission of the UCII22 spectrograph. Counters with a Pt cathode proved to be the most stable. Variation of the photoelectric efficiency of G.M. counters was investigated. Three types of changes are discussed. ***Kazimierz W. Ostrowski.*** *Acta Physica Polonica*, v. 18, no. 3, 1959, p. 231-253.

934 Advances in Electronics and Electron Physics. ***L. Marton and Claire Marton, et al., editors.*** v. 11. 523 pp. 1959. Academic Press, New York. (TK161 A95e Vis.)

935 Should the Laws of Gravitation Be Reconsidered? I. Abnormalities in the Motion of a Paraconical Pendulum on an Anisotropic Support. Reviews abnormalities observed and the manner in which they should be interpreted. ***Maurice F. C. Allais.*** *Aero/Space Engineering*, v. 18, Sept. 1959, p. 46-52.

936 Should the Laws of Gravitation Be Reconsidered? II. Experiments in Connection With the Abnormalities Noted in the Motion of the Paraconical Pendulum With an Anisotropic Support. Describes experiments in connection with these abnormalities observed in the motion of a paraconical pendulum on an anisotropic support, relating them to phenomena noted in mechanics, optics, and electromagnetism—and concludes that they can be accounted for "only by considering the existence of a new field". ***Maurice F. C. Allais.*** *Aero/Space Engineering*, v. 18, Oct. 1959, p. 51-55.

937* The Role of the Field in the Formation of the Photoelectret Heterocharge. Considers the field during the formation of a photoelectret condition in a single crystal by including in three different equations a member allowing for the divergence of the current. *(In Russian.)* Rol' polia pri obrazovanii geterozariada fotoelektreta. ***B. M. Golovin, N. T. Kashukeev, and V. M. Fridkin.*** *Akademiia Nauk SSSR, Doklady*, v. 128, no. 1, Sept.-Oct., 1959, p. 63-66.

938* Measurement of Electric Poles in a High-Frequency Discharge at Low Pressure by Means of an Electron Beam. Applied to the study of a high-frequency E-discharge at low pressure, the electron beam method allows measurement of the intensity of the high-frequency pole and of the pole of the transversal discharge in different parts of the discharge interval at the same time. The distribution of the electrical poles, with a potential and transversal charge in high-frequency discharge in argon at 10^{-2}mm Hg for different moments was considered. (*In Russian.*) Izmerenie elektricheskikh polei v vysokochastotnom razriade nizkogo davleniia pri pomoshchi elektronnogo puchka. ***G. S. Solntsev, A. G. Porokhin, and N. M. Chistiakova.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Fizicheskaia*, v. 23, no. 8, Aug. 1959, p. 1026-1030.

939* Symmetry Properties of Molecules and Crystals, and the General Classification of Point Groups. A general classification of point groups according to the presence or absence of axes of symmetry of the $n > 2$ order is useful in investigating problems of the offices and spectroscopy of molecules and crystals. *(In Russian.)* Svoistva simmetrii molekul i kristallov i obshchaya klassifikatnia tochechnykh grupp. ***M. A. Eliashevich.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 2, Feb. 1959, p. 44-46.

940* The Form of a Hysteresis Loop of Polycrystals. The problem of calculating the magnetic interaction of the individual crystals was studied and the Akulov method was applied to solving the Reley formula for a hysteresis loop in low fields. (*In Russian.*) Forma petli gisterezisa polikristallov.

N. S. Akulov. Akademiia Navuk Belaruskaia SSR, Doklady, v. 3, no. 7, July 1959, p. 294-297.

941 New Look at the Theory of Electron-Phonon Resonance. I. Develops the quantum mechanics of an electron in a linear lattice capable of longitudinal vibrations. ***William Band.*** *American Journal of Physics*, v. 27, no. 6, Sept. 1959, p. 397-403.

942 Heisenberg's Contracting Wave Packets. The discontinuous contraction of a wave packet preceded and followed by a continuous expansion controlled by Schrödinger's equation is a much discussed difficulty in the quantum theory of measurement. It is shown to rest on a mistaken interpretation of Schrödinger's equation as a "process equation" and on two different usages of the word "state". ***Alfred Landé.*** *American Journal of Physics*, v. 27, no. 6, Sept. 1959, p. 415-417.

943 Energy Moment Method in Quantum Mechanics. Relates the physical parameters associated with the description of a quantum mechanical system to energy eigenvalues of the wave equation of the system in such a manner that for relatively simple systems the physical parameters can be evaluated from experimental data without effecting a detailed solution for the roots of the secular equation. ***Paul M. Parker and L. Carlton Brown.*** *American Journal of Physics*, v. 27, no. 7, Oct. 1959, p. 509-514.

944* Voltage Breakdown of Rapid Sparks. An investigation of the statistical dispersion and breakdown time of rapid sparks under excessive voltage. By means of the proper circuit arrangement, a spark gap was given up to 260% excessive voltage. Due to the steady increase of the voltage impulse during the building up of the spark track, the curve of distribution of the spark dispersions has a maximum. *(In German.)* Spannungszusammenbruch an schnellen Funken. ***E. Rose.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 15-35.

945* Photochemical Formation of Organic Compounds From Simple Gas Mixtures. These simple organic compounds can be obtained from gas mixtures of methane or ethane with ammonia and water steam. Reactions sensitized with Hg in ethane, ammonia and steam mixtures yielded simple amino acids and lower fatty acids, which were analyzed quantitatively. By direct photolysis of methane-ammonia-steam mixtures with the resonance wavelengths of Xe, glycine was formed, which was detected by paper chromatography. *(In German.)* Photochemische Bildung organischer Verbindungen aus Mischungen einfacher Gase. ***W. Groth and H. v. Weyssenhoff.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 69-77.

946* Thermoelectric Voltage and Heat Conduction of III-V-Compounds and Their Solid Solutions. In III-V-compounds there is an analogy between the thermal conductivity and the reciprocal thermal expansion coefficients. Whereas the thermal conductivity of the solid solutions $In(As_yP_{1-y})$ at y equals 0.5 as a minimum, the electron mobility decreases steadily from InAs to InP. At the same time effective electron- and hole dimensions increase. The free length of path of the electrons must be by one order of magnitude longer than that of the phonons. *(In German.)* Thermospannung und Wärmeleitung von III-V-Verbindungen und ihren Mischkristallen. ***H. Weiss.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 121-131.

947* A Contribution to the Study of the Spectral Sensitivity of Photographic Layers. Photographic silver bromide layers exhibit a spectral sensitivity for radiation above 490 nm in proportion to the number of centers of disturbance of physical or chemical origin in the AgBr crystals. Sensitizing coloring substances increase the spectral sensitivity in the same domain by increasing the light absorption of the system conceived as a unit relative to the band model also. *(In German.)* Zur spektralen Empfindlichkeit photographischer Schichten. ***J. Eggert.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 140-144.

948* Couplings Between Barkhausen Effects as a Result of Magnetic Aftereffect. Describes a method which permits the determination of regular interrelationships in the sequence of impulses in time. The investigation of the Barkhausen-impulse as produced in the magnetization phenomenon, reveals high reciprocal couplings which cause the appearing of individual impulse groups. The number and distance of the impulse of these groups are approximately independent of the external field emission. *(In German.)* Kopplungen zwischen Barkhausen-Sprüngen als Folge magnetischer Nachwirkung. ***H. Bittel and I. Westerboer.*** *Annalen der Physik*, v. 4, nos. 1-5, July 1959, p. 203-215.

949* Relationship Between the Amplitude and Phase Variation of an Electromagnetic Wave. When energy is extracted from a guided electromagnetic wave a phase shift occurs with a sign which is often one of the main characteristics. In a number of special cases (constant factor of asymmetry process) the phase shift is almost always a phase lead for series type coupling and a lag for shunt type coupling. When coupling is symmetrical, this statement is always verified. *(In French.)* Relation entre les variations d'amplitude et de phase d'une onde électromagnétique. ***G. Broussaud.*** *Annales de Radioélectricité*, v. 14, no. 57, July 1959, p. 250-259.

950* Electron Interactions. II. Properties of a Dense Electron Gas. Concerned with the detailed calculation of the effects of the interaction on the properties of an electron gas. The lowest order exchange correction to the plasmon energy is computed and found to be small in all cases of physical interest. However, the lowest order contributions to the plasmon damping are seen to modify the observed cutoff for plasmon excitation in electron energy loss experiments in a not negligible way. ***D. F. DuBois.*** *Annals of Physics*, v. 8, Sept. 1959, p. 24-77.

951* Nuclear Resonance in Solid and Liquid Metals: A Comparison of Electronic Structures. The electronic structures of ten solid and liquid metals are investigated experimentally and theoretically, and the results of recent nuclear resonance measurements are correlated with already published data concerning magnetic susceptibility, electrical conductivity and atomic arrangement. ***W. D. Knight, A. G. Berger and V. Heine.*** *Annals of Physics*, v. 8, Oct. 1959, p. 173-193.

952* Ground State and Low Excited States of the Negative Hydrogen Molecule Ion. The potential curves have been calculated in the range of R-values from 1 to 10 a.u. The following states, arranged according to increasing value of the minimum energy, are found to correspond to discrete energy levels: $^2\Sigma_u^+$, $^2\Pi_u$, $^2\Sigma_g^+$, $^2\Sigma_u^+$, and $^4\Sigma_u^+$. The minimum of the potential curve for the ground state is found at $R=1.65$ a.u. and $E=-1.1057$ a.u., corresponding to a dissociation energy $D_e=59$ kcal/mole. H_2^- is thus found to be comparatively stable towards dissociation into H and H^-. ***Inga Fischer-Hjalmars.*** *Arkiv för Fysik*, v. 16, no. 1, 1959, p. 33-55.

953* Diffraction Patterns of Small Phase Objects Measured in the Microwave Region. The intensity of radiation in the electric plane was measured along the axis and close behind the diffracting object in several planes transverse to the incident beam direction. The patterns are compared with theoretical computatons obtained using a modification of the Huygens-Kirchhoff theory of diffraction. ***Olof Bryngdahl.*** *Arkiv för Fysik*, v. 16, no. 1, 1959, p. 69-92.

954* A Stepwise Increase in the Electron Current to a Probe Held in a Gas Discharge in a Magnetic Field. The preliminary results of an investigation of the effects of a magnetic field on the diffusion of electrons in a plasma were indicated. The critical magnetic field changes in proportion to the pressure of the gas. There seems to exist two qualitatively different mechanisms of the transversal shift of electrons, one of which is the diffusion due to collision. *(In Russian.)* Skachkoobraznoe uvelichenie elektronnogo toka na zond v razriade v magnitnom pole. ***A. V. Zharinov.*** *Atomnaia Energiia*, v. 7, no. 3, Sept. 1959, p. 215-219.

955* A Cryostat for Measuring Specific Heats Between 1 and 4.2° K Using a Mechanical Thermal Switch. A design for a low temperature cryostat using a mechanical thermal switch is described and its performance and some general features of interest in its operation, such as the importance of vibration, are discussed. Sample measurements on pure Cu and a Cu-Ni alloy are presented. ***F. D. Manchester.*** *Canadian Journal of Physics*, v. 37, Sept. 1959, p. 989-1001.

956* On "Plastic" Waves in Solids. The study of the propagation in solids has reached a stage where it is necessary to consider which direction future research should take. In the

past 90 or so years many experiments, mostly designed to elucidate certain points of engineering significance, and a few attempts at a theoretical study have cast some light on the subject and revealed it as one of formidable difficulty. Part of the paper is devoted to a description of an apparatus which gives results capable of being interpreted with a very minimum of theory. The remainder of the paper is devoted to a short review of past work with particular emphasis on basic phenomena and to a brief discussion on the most pressing problems still remaining. ***John M. Bowsher.*** *Canadian Journal of Physics*, v. 37, Sept. 1959, p. 1017-1035.

957* Irreversible Thermodynamics and Kinetic Theory in the Derivation of Thermoelectric Relations. In the past, irreversible thermodynamics has been used to provide a satisfactory derivation of the Thomson relations. It appears that what one might call a general "primary equation" of thermoelectricity can be derived from irreversible thermodynamics, and that this should be of direct use in kinetic discussions. ***J. W. Leech.*** *Canadian Journal of Physics*, v. 37, Sept. 1959, p. 1044-1054.

958 Progress Made on Semiconductors. Boston technical session reveals promise of gallium arsenide transistors, plus several other advances. *Chemical and Engineering News*, v. 37, no. 37, Sept. 14, 1959, p. 34.

959* Thermodynamic Constants. The dimensionless material parameters that must be introduced into the reduced equations of state in addition to the pressure, temperature and volume, in order to extend the range of applicability of the classical law, must be considered to be thermodynamic constants between which relationships exist. They should be called by the names of their researchers. (*In German.*) Thermodynamische Kennzahlen. ***R. Plank.*** *Chemie-Ingenieur-Technik*, v. 31, Sept. 1959, p. 576-579.

960* The Electromagnetic Energy Momentum Tensor in the Presence of Charged Matter. When fields and inductions exist at the same time, different symmetrical tensors capable of representing the energy impulse can be formed, starting with asymmetric tensors. The choice between these different tensors remains arbitrary. (*In French.*) Le tenseur d'impulsion-énergie électromagnétique en présence de matière chargée. ***Stamatia Mavridès.*** *Comptes Rendus Hebdomadaires des Séances de l'Académie des Sciences*, v. 249, no. 5, Aug. 3, 1959, p. 637-639.

961* Irreversible Magnetic After-Effect in Ferromagnetic Materials. Discusses the after effect in ferromagnetic materials in terms of two classifications, namely, (1) diffusion or reversible after-effect, (2) fluctuation or irreversible after-effect. ***O. Yamada.*** *ETJ of Japan*, v. 4, no. 4, Dec. 1958, p. 119-122.

962* High-Temperature Source. Scientist at the Avco Research and Advanced Development Division in Wilmington uses an ultrasonic pulse system to measure the temperature of the new plasma jet developed by Avco. The quartz probes extend into the plasma flame and transmit and receive sound pulses which are converted to temperature measurements. The small plasma generator has been measured above temperatures of 12,000 F. *Electromechanical Design*, v. 3, no. 9, Sept. 1959, p. 37.

963 Fast Reactions in Solids. Deals in particular with the mechanism by which an explosive crystal can decompose when subjected to heat, light, shock, or nuclear radiation. The decomposition may begin slowly and then accelerate to a very high velocity. High resolution electron microscopy combined with electron diffraction is used to investigate the early stage of decomposition, and fast photography and electronic methods are employed to follow the rapid reaction. ***F. P. Bowden and A. D. Yoffe.*** 157 pp. 1958. Butterworths Scientific Publications, London. (QD516 B67f)

964* General Quantum Theory of the Collision Process. A description of the collision processes between elementary particles, atom and general particles, covering such subjects as the introduction of the concept of the S-matrix, the general formulation of the mathematical problem for the determination of S, the values of S in connection with the space-time aspect of various processes, and the qualitative limitations resulting for S. (*In German.*) Allgemeine Quantentheorie der Stossprozesse. ***W. Brenig and R. Haag.*** *Fortschritte der Physik*, v. 7, nos. 4/5, 1959, p. 183-242.

965 Fourier Transforms and X-Ray Diffraction. An introduction to Fourier-transform theory that would serve as a basis for those who wish to apply the theory to X-ray diffraction. ***H. Lipson and C. A. Taylor.*** 76 pp. 1958. G. Bell and Sons, London. (QD945 L66f)

966* Huyghens' Principle and the Diffraction of Light. I. Theoretical Considerations. The conventional treatment of diffraction problems based on the so-called Principle of Huyghens as analytically formulated by Kirchhoff is based on a misunderstanding of the original ideas of Huyghens regarding the propagation of light. It is possible to base a theory of diffaction on Huyghens' concept of partial waves and his explanation of the reflection and refraction of light at the boundary between media with different optical properties. ***C. V. Raman.*** *Indian Academy of Sciences, Proceedings*, v. 50, sec. A, no. 2, Aug. 1959, p. 83-90.

967* Space Group Symmetry of $K_2Cr_2O_7$. The method of intensity statistics of X-ray reflections has been employed to resolve the controversy about the space group of the triclinic room temperature form of $K_2Cr_2O_7$. Intensity distribution curves definitely indicate the presence of center of symmetry showing that the crystal belongs to the space group Pl. ***G. Sivasankara Rao.*** *Indian Institute of Science, Journal*, v. 41, sec. A, no. 3, July 1959, p. 47-51.

968* A Contribution to the Structure of Binary Crystals Theory. The conditions of existence of cubic lattices of the NaCl, Zns and CsCl types containing a bond expressed by the Born formula were examined. It was shown that the conditions of existence of lattices of the ZnS type, in the case of the suggestions offered concerning the forces of the bond, can be obtained. (*In Russian.*) K teorii struktury binarnykh kristallov. ***V. A. Zhdanov and V. F. Konusov.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1959, no. 3, p. 45-54.

969* Hardening and Softening of Alloys Based on Nickel. The result of the X-ray examination of a thin crystalline structure (distorted lattice of the second type, mosaic blocks) and of the hardness of some alloys based on Ni in the hardened state and during thermal softening were studied. A relationship between the pattern of the softening curves and the growth of the mosaic blocks was shown. (*In Russian.*) Uprochnenie i razuprochnenie splavov na nikelevoĭ osnove. *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1959, no. 3, p. 78-83.

970* Electrical Conductivity of Cadmium and Zinc Selenides. A study of the electrical conductivity of CdSe compounds in single crystals and massive polycrystals and in thin layers and also of the electrical conductivity of a ZnSe compound on thin layers in relation to the thickness of the layer, to the thermal treatment and to the material of the contacts. (*In Russian.*) Elektroprovodnost' selenidov kadmiia i tsinka. ***M. V. Kot and A. V. Simachkevich.*** *Izvestiia Vysshikh Uchebnykh Zavedenĭ, Fizika*, 1959, no. 3, p. 125-131.

971* Magnetic Resonance of Atomic Levels Excited by Electron Bombardment. I. Electron bombardment produces alignment in the atomic excited states reached in a Franck and Hertz type of experiment. In the Hg atom, resonances have been observed in the 6 $^3F_4$, $5d^9$ $6s^2$ $6p$ $^1D_2$ levels and in a $^3P_2$ level the configuration of which has not been determined with certainty. (*In French.*) Résonance magnétique de niveaux atomiques excités par bombardement électronique. I. ***J. C. Pebay-Peyroula.*** *Journal de Physique et le Radium*, v. 20, no. 7, July 1959, p. 669-679.

972 Measurement of Thermal Conductivity by Utilization of the Peltier Effect. Straightforward measurements allow calculation of the absolute value of the thermoelectric power, thermal conductivity, and electrical resistivity. An especially useful feature of the method is that the thermoelectric figure of merit is given in terms of the ratio of two voltages. The theory is presented for the case in which the radiative heat transfer is important. The method has been tested experimentally at 300 K only, but analysis suggests that accurate measurements of thermal conductivity can be made by this technique on low thermal conductivity materials of small dimensions up to 1000 K. ***T. C. Harman, J. H. Cahn, and M. J. Logan.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1351-1359.

973 New Method for Range Measurements of Low-Energy Electrons in Solids. In the new method, the material under study is deposited on a thick layer of greatly different electron backscattering characteristics. When the incident electrons have just sufficient energy to penetrate to the support and return to the surface, a marked change in the backscattered fraction occurs. In this manner, the need for very thin organic supporting films of unknown stopping power is avoided. Range-energy data from 1 to 15 kev for films of aluminum on a gold substrate obtained by this technique are found to agree with the data obtained by the use of cathode luminescence to detect electron penetration. The technique was applied to thin films of gold in the energy region from 2 to 15 kev. ***J. E. Holliday and E. J. Sternglass.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1428-1431.

974 Thermoelectric Properties of the Plasma Diode. The complete circuit of diode and load is treated as a thermocouple, and expressions for both Seebeck emf and thermoelectric conversion efficiency are obtained as a function of cathode and anode temperatures. The interior of the diode is divided, for convenience, into three regions: (1) the cathode sheath, (2) main body of plasma, and (3) the anode sheath. ***H. W. Lewis and J. R. Reitz.*** *Journal of Applied Physics*, v. 30, Sept. 1959, p. 1439-1445.

975* Calculation of Electron-Beam Divergence at Medium Gas Pressures. In the calculation of the divergence of long electron beams, perfect vacuum conditions are generally assumed to exist. The presence of gas within the tube cannot be avoided; its effect is to reduce the dispersive forces on the beam. The effect of gas on beam divergence has not thus far been susceptible to analytic solution; however, a numerical approach based on the use of universal curves and step-by-step integration is found to be capable of giving a reasonable estimate of the beam profile in the presence of gas. ***B. H. Wadia.*** *Journal of Electronics and Control*, v. 6, no. 4, Apr. 1959, p. 307-320.

976* Relaxation Polarization Dielectrics. An Assessment of the System (Sr, Ba, Ca) TiO_3-Bi_2O_3-TiO_2. Ceramic solid solutions of the system $SrTiO_3$-$Bi_2O_3 \cdot nTiO_2$, where n was varied between 0 and 4, were prepared from $SrCO_3$ or $SrTiO_3$, Bi_2O_3 and TiO_2 in a wide range of compositions for assessment as capacitor dielectrics. The effect of partial and complete substitution of Ba or Ca for Sr has also been investigated. Dielectrics have been prepared with permittivities of up to 1500 at room temperature and a negative temperature coefficient above −80 C. Some compositions examined had dielectric loss tangents below 0·003 over the range −30 C to 200 C at frequencies below 1 Mc/s, and promise to be useful as capacitor dielectrics. ***R. M. Glaister and J. W. Woolner.*** *Journal of Electronics and Control*, v. 6, no. 5, May 1959, p. 385-396.

977* Application of the Relaxation Method to the Solution of Space Charge Problems. Describes a numerical method of solution of the space charge equation in one dimension. The advantages of the method are its speed and flexibility. ***P. A. Lindsay.*** *Journal of Electronics and Control*, v. 6, no. 5, May 1959, p. 415-431.

978* High Resolution Electron Microscopy of Crystals. Examples are given of lattices resolved directly (including superlattices) and indirectly (by means of moiré patterns), and of other periodic phenomena associated with crystal lattices (domains in ordered alloys). The basic principles of image formation in periodic objects are considered in terms of simple diffraction theory and some indications given of limiting factors in this type of investigation. ***G. A. Bassett, J. W. Menter, and D. W. Pashley.*** *Journal of Photographic Science*, v. 7, no. 3, May-June 1959, p. 60-65.

979* A Method of Testing Optical Flatness of Pre-Polished Glass Surfaces. Describes a method for the quantitative estimation of the form of an optical surface, just before polishing. The optical level with suitable modifications was used for the purpose, so that departures from a standard form, say an optical flat, could be evaluated in terms of wavelengths of light. Results obtained are verified by interference methods. ***A. Shahul Hameed and S. Hariharan.*** *Journal of Scientific & Industrial Research*, v. 18A, July 1959, p. 311-313.

980 Electron-Optical Design of an X-Ray Micro-Analyser. The electron-optical system has to fulfill conditions not normally encountered—for example, in the electron microscope where the optimum design has been extensively studied. A system is described that has proved suitable for a practical X-ray microanalyzer using magnetic lenses of axial symmetry. ***T. Mulvey.*** *Journal of Scientific Instruments*, v. 36, Aug. 1959, p. 350-355.

981 Methods of Experimental Physics. v. I. Classical Methods. Includes the most recent developments in experimental technology and theoretical justification, leaving out those techniques which have only historical interest. ***L. Marton and Immanuel Estermann, editors.*** 596 pp. 1959. Academic Press, New York. (QC41 M56)

982 Methods of Experimental Physics. v. VI. Solid State Physics. A concise, well-illustrated presentation of the most important methods, or general principles, needed by the experimenter, complete with basic references for further reading. Indications of limitations of both applicability and accuracy are an important part of the presentation. Information about the interpretation of the experiments, about the evaluation of errors, and about the validity of approximations are also given. ***L. Marton, K. Lark-Horovitz, and Vivian A. Johnson, editors.*** 466 pp. 1959. Academic Press, New York. (QC41 M56)

983 Emission of Relatively High-Energy Ions From Low-Voltage Ares. In the experiments described, the arc is formed between a tungsten, molybdenum or tantalum filament, which is separately heated, and a nickel anode at a distance of about 5 cm., and is maintained in a rare gas, usually argon, at a pressure of 1-50 mm. mercury. The applied potential difference is 40-80 V. and the current is 200-500 m.amp. The arc is thermally constricted or "pinched" to a diameter of approximately 5 mm. ***E. R. Harrison.*** *Nature*, v. 184, July 25, 1959, p. 245-246.

984* Mass Spectroscopy as a Research Tool. ***A. H. Turnbull.*** *Nuclear Power*, v. 4, Sept. 1959, p. 108-111.

985 Theory of the Concave Grating. III. Seya-Namioka Monochromator. As an example of a mounting in which the optical components are not on the Rowland cylinder, the Seya-Namioka mounting is treated mainly from the standpoint of physical optics. An ambiguity in the physical meaning of Beutler's focal conditions is clarified; using the corrected condition, a brief summary of the optical conditions in this mounting is given. Astigmatism, spectral line shape, instrumental resolving power, and optimum grating width are discussed in detail. ***T. Namioka.*** *Optical Society of America, Journal*, v. 49, Oct. 1959, p. 951-961.

986 Modern Acoustical Engineering. I. General Principles. Deals with the principles of acoustic installations both for the amplification of sound and the improvement and control of auditorium acoustics. Some practical installations will be described at greater length in part II. ***D. Kleis.*** *Philips Technical Review*, v. 20, no. 11, Sept. 1959, p. 309-326.

987 Approach to Boltzmann Equilibrium of the Nuclear Spins in a Quadrupolar Solid. A single crystal of $NaNo_3$ is oriented in an external magnetic field at an angle (θ_1) for which the quadrupole splitting is large. With radio-frequency radiation, a pair of Zeeman levels of the Na nuclear spin system ($I = 3/2$) is saturated. Then the crystal is quickly rotated to an angle where the inequality of the level spacings is a minimum (approximately 1/2 the line width) and where spin mixing can take place. The crystal is then quickly returned to θ_1 where, by nuclear resonance pulse techniques, the populations of the four Na levels can be determined. This sequence of operations is completed in a time short compared to the spin-lattice relaxation time. When the $m = \pm 1/2$ levels are initially saturated, the spin system rapidly comes to the expected spin temperature $T_s = (10/9) \times$ (the lattice temperature). When the outer satellites are saturated, however, the resulting equilibrium populations of the levels are not those of a Boltzmann distribution. ***Walter I. Goldburg.*** *Physical Review*, v. 115, 2nd ser., no. 1, July 1, 1959, p. 48-56.

988 Transitions From Ferromagnetism to Antiferromagnetism in Iron-Aluminum Alloys. Theoretical Interpretation. Complicated magnetic properties of α-phase Fe-Al alloys

are successfully described from a theory with a few simple assumptions concerning the magnetic interaction between Fe atoms. Two interactions are considered: the direct exchange interaction between nearest neighboring Fe atoms and the indirect superexchange interaction between Fe atoms separated by an Al atom. ***Hiroshi Sato and Anthony Arrott.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1427-1440.

989 Nuclear Magnetic Resonance Acoustic Absorption in KI and KBr. A technique for measuring the coupling between nuclear spins and the crystal lattice is described. Nuclear magnetic resonance acoustic absorption measurements were made on single crystal samples of KI and KBr using compressional waves in the [100] direction. Interpreting these results on the basis of a point charge model we obtain values of the amplification factor γ. For KI^{127}, $\gamma = 38$. For KBr^{81}, $\gamma = 26$. ***D. I. Bolef and M. Menes.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1441-1451.

990 Recovery of Electron-Irradiated Copper. II. Interstitial Migration. ***J. W. Corbett, R. B. Smith, and R. M. Walker.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1460-1472.

991 Pressure Effects in Luminescence: Isobaric Experiments on NaI(Tl). The effect of steady-state hydrostatic pressure on the properties of luminescent systems, with particular reference to the phosphorescence of NaI(Tl), is examined. It is shown that readily observable changes in decay mean life may be produced by very modest pressures. Experimental results are in good agreement with these theoretical expectations. ***L. Reiffel.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1493-1499.

992 Model of a Linear Harmonic Oscillator in the General Theory of Relativity. Based on a classical model of a point mass vibrating harmonically about the center of an ideal liquid sphere. The motion is no longer harmonic. However, to a first approximation, it is still harmonic, but the period of vibration depends both on the amplitude and on the curvature of the space. Both quantities tend to slow down the motion. In the limiting case of flat space, the classical frequency is again restored. ***Henry Zatzkis.*** *Physical Review*, v. 114, 2nd ser., no. 6, June 15, 1959, p. 1645-1647.

993 Electromagnetic Properties of Superconductors. An integral relationship between the super current and the vector potential of the electromagnetic field, similar to Pippard's phenomenological equation, is derived from the gage-invariant theory of Wentzel. Expressions for coherence distance and penetration depth have been calculated. ***K. K. Gupta and V. S. Mathur.*** *Physical Review*, v. 115, 2nd ser., no. 1, July 1, 1959, p. 75-78.

994 Wave Function for the Free Electron. I. The Coulomb Potential. A sample calculation involving the neutral O atom is carried through. From the single-determinant wave function for the ^3P ground state of this atom the Coulomb potential is developed, and the important parts of the potential for the *s*- and *d*-wave portions of the free-electron wave function are considered. In our O example the wave function calculations were carried out for values of the free-electron linear momentum ranging from 0.01 through 0.80 atomic unit. ***R. G. Breene, Jr. and Maria C. Nardone.*** *Physical Review*, v. 115, 2nd ser., no. 1, July 1, 1959, p. 93-96.

995 Geometry of Gravitation and Electromagnetism. An independent derivation is given of equations first derived by Rainich which show how, under certain circumstances, the combined theory of gravitation and electromagnetism of Einstein and Maxwell can be unified and described exclusively in terms of geometry. Some algebraic relations are presented between the Ricci tensor, the electromagnetic field tensor, and their principal null vectors. It is shown that in regions of spacetime where the two invariants of the electromagnetic field both vanish, the unified theory cannot apply. ***Louis Witten.*** *Physical Review*, v. 115, 2nd ser., no. 1, July 1, 1959, p. 206-214.

996 Electron and Ion Runaway in a Fully Ionized Gas. I. Hydrodynamic equations are used to describe the flow of the electrons and ions of a fully ionized gas under the action of an electric field, *E*, of arbitrary magnitude. ***H. Dreicer.*** *Physical Review*, v. 115, 2nd ser., no. 2, July 15, 1959, p. 238-249.

997 Ultrasonic Attenuation in Bismuth at Low Temperatures. The attenuation has been measured at frequencies between 12 and 84 Mc/sec for various orientations. The magnetic field dependence of the attenuation at low temperatures exhibits three distinct oscillatory components and a saturation region at fields between 5 and 1600 oersteds. A simple interpretation of the salient features of the observations is presented. ***Darrell H. Reneker.*** *Physical Review*, v. 115, 2nd ser., no. 2, July 15, 1959, p. 303-313.

998* Knight Shift in Superconductors. ***Richard A. Ferrell.*** *Physical Review Letters*, v. 3, no. 6, Sept. 15, 1959, p. 262-265.

999* Plasma Jet Piercing of Magnetic Fields and Entropy Trapping Into a Conservative System. ***James L. Tuck.*** *Physical Review Letters*, v. 3, no. 7, Oct. 1, 1959, p. 313-318.

1000* Gauge Dependence of the Wave-Function Renormalization Constant in Quantum Electrodynamics. ***Kenneth Johnson and Bruno Zumino.*** *Physical Review Letters*, v. 3, no. 7, Oct. 1, 1959, p. 351-352.

1001 On the Lattice Theory of Expansion. An investigation was made of the expansion coefficient of two-dimensional lattices—ionic lattices and the close packed hexagonal lattice with central forces. A survey was made of the Grüneisen constants γ_v of a representative set of vibrations in reciprocal space. From these a set of functions are constructed from which the variation of the Grüneisen constant γ can be calculated, and which also permit one to see the reasons for the variation. ***M. Blackman.*** *Physical Society, Proceedings*, v. 74, pt. 1, July 1959, p. 17-26.

1002 The Forward Scattering of Light by Spheres According to Geometrical Optics. If the light scattering by transparent spheres is calculated according to geometrical optics, a large part of the scattered flux falls within a cone of half-angle $|m - 1|$ radians around the forward direction, where m is the refractive index of the sphere relative to the surrounding medium. ***J. McK. Ellison and C. V. Peetz.*** *Physical Society, Proceedings*, v. 74, pt. 1, July 1959, p. 105-123.

1003 Susceptibility of Superconducting Spheres. Derives an expression for the magnetic susceptibility of a sphere in a homogeneous applied field, assuming a quite general linear relation between the magnetization M and induction B inside the sphere. ***R. M. May and M. R. Schafroth.*** *Physical Society, Proceedings*, v. 74, pt. 2, Aug. 1959, p. 153-160.

1004 The Thermal Conductivity of Monatomic Dielectric Liquids. A new distribution function for molecular doublets is deduced which is appropriate to non-uniform temperature and involves the coordinates of the center of mass and the relative coordinates. This distribution function is superior to those put forward previously as it takes account of the uniformity of pressure and the vanishing of flow in a steady gradient of temperature. By means of this distribution function an expression for the coefficient of thermal conductivity is obtained which differs from similar expressions as put forward by previous authors. ***R. Eisenschitz and A. R. Boot.*** *Physical Society, Proceedings*, v. 74, pt. 2, Aug. 1959, p. 208-216.

1005 Thermodynamics of Electrically Conducting Fluids. A formula is derived which provides the basis for a complete study of the thermodynamics of fluid medium under the action of both electromagnetic and mechanical changes. ***Boa-Teh Chu.*** *Physics of Fluids*, v. 2, no. 5, Sept.-Oct. 1959, p. 473-484.

1006 Collisionless Plasma Shock. The structure of an extremely strong magnetohydrodynamic shock is discussed in the limit of no particle collisions. It is tentatively concluded that the shock transition takes place through the mechanism of a strong electric field produced by charge separation. ***Stirling A. Colgate.*** *Physics of Fluids*, v. 2, no. 5, Sept.-Oct. 1959, p. 485-493.

1007 Mutual Reflection of Two Shock Waves of Arbitrary Strengths. Experiments were performed in air on the mutual reflection of a pair of weak shock waves of strength $\epsilon = 0.915$. The regular reflection data agreed with the weak shock regular reflection solution for the flow. Four sets of experiments were performed in air with pairs of mutually reflecting shock waves of unequal strengths. The regular data agreed with the weak shock regular reflection solution for the flow. The experiments

failed to resolve any of the difficulties concerned with Mach reflection. ***W. R. Smith.*** *Physics of Fluids*, v. 2, no. 5, Sept.-Oct. 1959, p. 533-541.

1008 Theory of Flames Produced by Unimolecular Reactions. I. Accurate Numerical Solutions. The time dependent flame equations are presented in complete generality, including the effects of thermal diffusion, radiation, external forces, and pressure variations. The one-dimensional steady-state laminar flame supported by the unimolecular reaction $A \rightarrow B$ is studied carefully with special emphasis on the effects of heat transfer to the flame-holder. It is found that there is a maximum amount of heat transfer which permits a steady state. For heat transfers less than this maximum there are two possible solutions of the flame velocity. ***Joseph O. Hirschfelder and Alan McCone, Jr.*** *Physics of Fluids*, v. 2, no. 5, Sept.-Oct. 1959, p. 551-574.

1009 Principles of Quantum Electrodynamics. Includes sections on free fields, fields with external sources, and interacting fields. ***Walter E. Thirring.*** 234 pp. 1958. Academic Press, New York. (QC174.1 T34etr)

1010* Peculiarities of a Discharge With the Oscillation of Electrons in a Magnetic Field. During the change in a magnetic field two discharge conditions were found. The first one appears at H pressures $p < 2 \cdot 10^{-3}$mm of the Hg column and has its peculiarities in the interval of the change of the magnetic field within some tens of oersteds. The second one (of the arc type) appears at pressures $p\ 2 \cdot 10^{-3}$mm of the Hg column and has exits during the change of the magnetic field from a few hundred to one thousand oersteds. (*In Russian.*) Osobennosti razriada s kolebaniem elektronov v magnitnom pole. ***E. T. Kucherenko and O. K. Nazarenko.*** *Radiotekhnika i Elektronika*, v. 4, no. 8, Aug. 1959, p. 1253-1256.

1011 The Thermodynamic Behaviour of Solids. Outline of the main principles of thermodynamics, particularly in relation to the light they throw on the behavior of solids. ***M. A. Jaswon.*** *Research*, v. 12, July 1959, p. 274-284.

1012 On the Simultaneous Measurements of Particle Momentum and Ionization in a Cloud Chamber. Describes the difficulties arising in the construction of a cloud chamber for the simultaneous measurements of particle momentum and ionization, and studies the limitations inherent to the accuracies obtainable in the measurement of these two magnitudes; gives the best conditions to approach the maximum accuracies; finally, these accuracies are compared with those obtained in the best cloud chambers existing. (*In Italian.*) Sulle misure contemporanee di quantita di moto e da ionizzazione delle particelle in camera a nebbia. ***Bruno Brunelli.*** *Ricerca Scientifica*, v. 29, May 1959, p. 930-945.

1013* Coulomb Gauge in Non-Relativistic Quantum Electrodynamics and the Shape of Spectral Lines. An examination is made of the Green dyadic for the propagation functions of non-relativistic quantum electrodynamics in the Coulomb gage div A = O. The existence of false precursors is shown to be associated with singularities at the origin in certain momentum space representations of the propagators and this allows a prescription to be given to eliminate such precursors. The analogous treatment for the state vectors in decaying systems is carried through and is applied in detail to the problems of the shape of natural spectral lines and the transition rate for stimulated emission. The relationship of the calculations to a gage-independent Hamiltonian, considered in the paper, is investigated in detail. This Hamiltonian, transformed canonically from the conventional one, is shown to be valid for internal, dynamical, quantized electromagnetic fields; its analogue in the case of external applied fields being well known. ***E. A. Power and S. Zienau.*** *Royal Society of London, Philosophical Transactions*, v. 251, Ser. A. Mathematical and Physical Sciences, no. 999, Sept. 15, 1959, p. 427-454.

1014 Superconductivity: A Solved Problem? Modern theoretical physics has come close to explaining this hitherto baffling phenomenon. ***H. W. Lewis.*** *Science*, v. 130, Sept. 11, 1959, p. 599-601.

1015 Molecular Motions. One of the aims of molecular physics is to account for the bulk properties of matter in terms of the behavior of its particles. High-speed computers are helping physicists realize this goal. ***B. J. Alder and Thomas E. Wainwright.*** *Scientific American*, v. 201, no. 4, Oct. 1959, p. 113 + 8 pages.

1016* Cryogenics—A Survey. Outlines the history of investigation in the field of low-temperature physics. The properties of liquid He are given, and some of the phenomena which occur at temperatures near absolute zero are noted. Low-temperature techniques are discussed, and some of the applications of superconducting materials described. ***Allan Juster and Peter K. Shizume.*** *Sperry Engineering Review*, v. 12, no. 3, Oct. 1959, p. 2-10.

1017* Measuring Flame Temperature by Optical Methods. Tests proved that in a number of cases it is possible to calculate the divergence of the temperatures measured from their true values. (*In Russian.*) Ob izmerenii temperatury plameni opticheskimi metodam. ***K. P. Vlasov.*** *Teploenergetika*, v. 6, no. 9, Sept. 1959, p. 87-89.

1018 Thermodynamics. A book that combines three features, namely, an approach directed toward students, a rigorous treatment of fundamentals, and a distinctly engineering perspective. ***Gordon J. Van Wylen.*** 567 pp. 1959. John Wiley & Sons, New York. (QC311 V38t)

1019 Thermodynamics and Statistical Thermodynamics. Provides a concise but complete discussion of the new statistical methods used calculating thermodynamic properties of ideally gaseous organic compounds. The rapid development and standardization of statistical thermodynamics enabled the authors to compare accurately measured values of thermodynamic quantities with those calculated from molecular and spectroscopic data. Calculations involving electronic energy levels are examined to introduce other thermodynamic properties. ***John Geldart Aston and James John Fritz.*** 556 pp. 1959. John Wiley & Sons, New York. (QC311 As86t)

1020* Measurement of Dielectric Constant of Germanium at Microwave Frequencies. Measured in the temperature range from 1.6 to 300 K by the resonant cavity method. Temperature dependence of the relaxation time of charge carriers was estimated by using the simple classical relaxation formula. ***Tadao Fukuroi and Kazuo Yamagata.*** *Tôhoku University, Science Reports of the Research Institutes, Ser. A. Physics, Chemistry, Metallurgy*, v. 11, no. 4, Aug. 1959, p. 285-295.

1021 Thermodynamics of Unsteady Flow Processes Involving Transfer of Heat for Vented Containment Systems. First law of thermodynamics for changes of state and quantity of the working substance is presented. Included are mass balance, forms of energy utilized, and definitions of stagnation enthalpy and stored energy. From the equations for unsteady flow the familiar equations for steady flow are deduced. A special case of the first law of thermodynamics for changes of state and quantity is applied in the theoretical derivation on emptying of a vented containment structure having a constant heat source. ***J. C. Heap.*** *U. S. Atomic Energy Commission, ANL*-5987, July 1959, 58 pp. (UF767 Un3.1an Contin.)

1022 Principles of High Temperature Microscopy. Surveys the field of high temperature microscopy and adds to previous reviews the experience of more recent work. Since the temperature range from room temperature to 750 C has been adequately treated by Chamot and Mason and McCrone, it will not be considered. Instead, this paper will treat systems capable of studying phenomenon above 750 C to the limit of existence of elemental solids. ***B. B. Brenden, H. W. Newkirk, Jr., and J. L. Bates.*** *U. S. Atomic Energy Commission, HW*-58303, June 15, 1959, 40 pp. (UF767 Un3.1hw Contin.)

1023 Stopping Power of Thin Aluminum Foils for 12 to 127 Kev Electrons. ***Ford Kalil, W. G. Stone, H. H. Hubbell, Jr., and R. D. Birkhoff.*** *U. S. Atomic Energy Commission, ORNL*-2731, Sept. 16, 1959, 126 pp. (UF767 U30 Contin.)

1024 Interactions Between Molecules Adsorbed on a Surface. The "two molecule-surface potential" is derived from quantum mechanical third order perturbation theory. It is shown that this potential consists of two parts just as the energy giving the van der Waals attraction of a single molecule to a surface does. The third order energy, *i.e.*, the new intermolecular interaction caused by the surface, is directly related to the zero-coverage heat of adsorption and except for this experimental quantity, the results do not require specific

assumptions about the surface. The "fluctuation" or "dispersion" part of the third order energy is shown to yield a repulsion between two molecules in a "monolayer" that amounts to 20-40% of the gas phase Lennard-Jones potential minimum. ***Oktay Sinanoglu and Kenneth S. Pitzer.*** *U. S. Atomic Energy Commission, UCRL*-8835, Aug. 1959, 41 pp. (UF767 U3u Contin.)

1025 Solution Techniques in Fluorescent X-Ray Spectrography. Describes a Bureau of Mines study undertaken to determine the applications and limitations of solution techniques as a general method of fluorescent X-ray spectrographic analysis. ***William J. Campbell, Melvin Leon, and John W. Thatcher.*** *U. S. Bureau of Mines Report of Investigations*, 5497, 1959, 24 pp. (TN21 Un3r Vis.)

1026* Electron Beam Magnetometer. A theoretical investigation of the electron optics of an electron beam deflection method for detecting small magnetic fields is presented. It is shown that remarkably high sensitivity can be reached. A discussion of the possible improvements which could extend the sensitivity of the device is also given. ***L. Marton, Lewis B. Leder, J. W. Coleman, and D. C. Schubert.*** *U. S. National Bureau of Standards, Journal of Research, Section C, Engineering and Instrumentation*, v. 63C, no. 1, July-Sept. 1959, p. 69-75.

1027* The Attainment of Clean Surfaces by Breaking Crystals in Ultra-High Vacuum. Two experiments are described with the object of determining some of the electronic properties of semiconductor surfaces produced by fracture in high vacuum. In one experiment, the photoelectric emission is being measured from freshly broken indium antimonide and gallium arsenide, and from cleaved bismuth telluride. In the other experiment, the transverse mobility of induced surface charge and the photoconductivity are being investigated on Ge surfaces obtained by cleavage in a vacuum of the order 10^{-10} mm Hg. ***P. C. Banbury, G. A. Barnes, D. Haneman, and E. W. J. Mitchell.*** *Vacuum*, v. 9, no. 2, May 1959, p. 126-127.

1028* Concerning the "Backward Wave" in a Tubular Conductor Filled With Longitudinal Magnetization Plasma. If one measures the "backward waves" (that is, the waves in which the phase velocity and the group velocity have an opposite direction) by means of impacts of the electricity carriers with gas atoms, waves are produced increasing in the direction of the phase velocity. A thorough explanation of this phenomenon is given. *(In German.)* Über die "Backward Wave" im metallischen Hohlleiter, der mit längsmagnetisiertem Plasma gefüllt ist. ***Winfried Otto Schumann.*** *Zeitschrift für Angewandte Physik*, v. 11, no. 9, Sept. 1959, p. 333-335.

1029* A Contribution to the Systematology and Group Theory Derivation of the Symmetry-, Antisymmetry- and Degenerate-Symmetry Groups. Suitable symbols for variously periodic symmetry groups are introduced. A method of deriving the antisymmetry (AS) and degenerate symmetry (ES) groups from the character tables of irreducible representations of the symmetry (S) groups is explained. The following cases are treated: (1) the two-dimensional, single-periodic AS groups, (2) the 58 AS and 52 ES point groups corresponding to the 32 crystal classes. *(In German.)* Zur Systematik und gruppentheoretischen Ableitung der Symmetrie-, Antisymmetrie- und Entartungssymmetriegruppen. ***Alfred Niggli.*** *Zeitschrift für Kristallographie*, v. 111, no. 4, Aug. 1959, p. 288-300.

1030* Separation of Radioactive Xenon From Hydrogen and Deuterium by Means of Thermal Diffusion. The thermal diffusion factors of Xe in H_2 and D_2 were measured between 300 and 700 K. ^{133}Xe was used as tracer to determine the concentration. The constants of diffusion D_{Xe}-H_2 as well as D_{Xe}-D_2 were evaluated for hard spheres by means of the Chapman formula. A wire-wound barrel was built with optimum pressure near the atmospheric pressure. Separation factor, initial transfer and time of relaxation of the barrel were determined. *(In German.)* Abtrennung von radioaktivem Xenon aus Wasserstoff und Deuterium mittels Thermodiffusion. ***D. Heymann.*** *Zeitschrift für Naturforschung*, v. 14a, July 1959, p. 603-609.

1031* Experimental Investigations of Traps in Silicon. Traps produced in high purity Si by means of tempering were investigated in regard to their action. The trap mechanism is due to a delayed carrier recombination and not to a second emission into the minority band. *(In German.)* Experimentelle Untersuchungen von Haftstellen in Silicium. ***M. Zerbst and W. Heywang.*** *Zeitschrift für Naturforschung*, v. 14a, July 1959, p. 645-649.

1032* The Three Dimension Stabilization of Charge Carriers in a Quadrupole Field. Shows that particles of a specific charge e/m are confined in three dimensions by a high frequency electric quadrupole field. Theoretical predictions are verified by experiments with ions of different masses and with electrons. Mass selection, maximum number of stored charges and their mean life time in the field are measured. Influence of a magnetic field on the motion of the charges is investigated. *(In German.)* Die dreidimensionale Stabilisierung von Ladungsträgern in einem Vierpolfeld. ***E. Fischer.*** *Zeitschrift für Physik*, v. 156, no. 1, 1959, p. 1-26.

1033* A Study of Diffractions by Apertures in Screens, Which Are Not Plane. By means of an approximate method, diffraction by an aperture in a screen, which is not plane, is discussed. For the special case of a circular aperture in a funnel-shaped screen, the diffraction field on the axis behind the screen is computed for an incident scalar plane wave and for an incident electromagnetic plane wave propagating in the direction of the axis. *(In German.)* Zur Beugung an Öffnungen in nichtebenen Schirmen. ***Werner Braunbek.*** *Zeitschrift für Physik*, v. 156, no. 1959, p. 66-77.

1034* A New High-Refracting Substance for Dielectric Ultraviolet Mirrors. As a high-refracting substance in dielectric reflections for the spectral region between 3200 and 2400 Å, PbF_2 was found very appropriate because of its high resistance to dampness and of its relatively high index of refraction in comparison with substances used to this day. The index of refraction and of absorption of PbF_2 between 5000 and 2300 Å was given. *(In German.)* Eine neue hochbrechende Substanz für dielektrische Ultraviolett-Spiegel. ***G. Honcia and K. Krebs.*** *Zeitschrift für Physik*, v. 156, no. 2, 1959, p. 117-124.

1035* The Index of Refraction of Cadmium Sulfide. Single crystals of CdS developed in the form of thin laminas were observed in reflection and by radiation interference by means of multiple reflection. The indices of refraction for the unusual and usual ray between 5100 and 6500 Å at room temperature and between 4900 and 6500 Å at the temperature of liquid air have been indicated as well as the effect of the lattice defects on the indices. *(In German.)* Über den Brechungsindex von Cadmiumsulfid. ***H. Gobrecht and A. Bartschat.*** *Zeitschrift für Physik*, v. 156, no. 2, 1959, p. 131-143.

1036* On the Mechanism of Surface Ionization of Atoms of the Alkali Earth Metals. The concurrent surface ionization of the alkali earth metals Ba, Sr, Ca, and Mg and the alkali metal Na on incandescent W was investigated with a mass spectrometer. The ionization coefficients were found to be significantly higher when O was circulated about the W. The surface ionization of atoms of the alkali earth metals was found to be specific under the indicated conditions. *(In Russian.)* O mekhanizme poverkhnostnoĭ ionizatsii shchelochnozemel'nykh metallov. ***Iu. K. Szhenov.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 37, no. 2, Aug. 1959, p. 336-339.

1037* Theory of Paramagnetic Resonance in Systems Containing Two Types of Magnetic Moments. Equations of motion for the partial magnetizations of a system containing two types of interacting magnetic moments located in a weak, variable, magnetic field are obtained by methods of thermodynamics of irreversible processes. The same equations can be derived from the microscopic theory in the case of sufficiently fast thermal fluctuations of the local fields. The relaxation times and shift of the resonance frequency are computed. *(In Russian.)* Teoriia paramagnitnogo rezonansa v sistemakh soderzhashchikh dva sorta magnitnykh momentov. ***A. A. Kokin and G. V. Skrotskiĭ.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 37, no. 2, Aug. 1959, p. 482-489.

1038* Thermoelectric Phenomena in Strong Magnetic Fields in Metals Possessing Various Fermi Surfaces. The asymptotic behavior of the thermoelectric force, Peltier coefficients and Thomson coefficients for metals with closed Fermi surfaces and open surfaces of the "corrugated cylinder" and

"space net" type is investigated on the basis of the quasi-classical theory of kinetic phenomena in metals located in strong magnetic fields as developed by Lifshitz, Azbel, and Kaganov and Lifshitz and Peschansky. *(In Russian.)* Termoelektricheskie iavleniia v sil'nykh magnitnykh poliakh v metallakh s razlichnymi poverkhnostiami fermi. ***Iu. A. Bychkov, L. E. Gurevich, and G. M. Nedlin.*** *Zhurnal Eksperimental'noĭ i Teoreticheskoĭ Fiziki*, v. 37, no. 2, Aug. 1959, p. 534-539.

See also: **293** (nuclear magnetic resonance); **442** (solid state physics); **461** (X-ray diffraction).

PLASTICS

1039* Investigation of Radical Polymerization Processes in the Presence of Alien Substances. I. Effect of Organic Halogen Compounds on the Polymerization of Vinyl Acetate. Chain transfer constants of 30 different organic halogen compounds were determined at 70 C. Halogen hydrocarbons possessing halogen-carbon bonds of low binding energy, as bromoform, tetrabromomethane, monobromotrichloromethane, proved to be the most active. *(In Russian.)* Issledovanie protsessov radikal'noĭ polimerizatsii v prisutstvii postoronnikh veshchestv. I. Vliianie galoid-soderzhashchikh soedineniĭ na polimerizatsiiu vinilatsetata. ***A. A. Vansheidt and Gy. Hardy.*** *Acta Chimica Academiae Scientiarum Hungaricae*, v. 20, no. 3, 1959, p. 261-273.

1040* Machining Glass-Base Laminates. Procedures for sawing, punching, drilling, tapping, threading, turning, and other operations. ***E. G. Graesser.*** *Aircraft and Missiles Manufacturing*, v. 2, Sept. 1959, p. 18-19.

1041 The Elimination of Oxides of Nitrogen From Automobile Exhaust. Zinc-copper chromite, Fe chromite, Ba promoted Cu chromite and Cr promoted iron oxides are very efficient for removing nitrogen oxides in the presence of CO or in some cases in the presence of H_2 at temperatures of approximately 220 C and 320 C. It was further found that chromites are also very efficient for inducing oxidation of hydrocarbons and CO, in the absence or presence of NO, when sufficient O_2 is present. A few experiments are also presented showing the removal of NO_2, CO, and hydrocarbons from actual automobile exhaust. ***Francis R. Taylor.*** *Air Pollution Foundation, Report No.* 28, Sept. 1959, 49 pp. (TD884 Ai71.3r Vis.)

1042* Studying the Effect of Pressure on the Ability of Nuclearly-Substituted α-Methylstyrenes to Polymerization. II. Ortho-Substituted α-Methylstyrenes. A 6000 atm pressure was unable to overcome the steric hindrances to the polymerization of o-substituted α-methylstyrenes. Copolymers of o-substituted methylstyrenes with styrene and p-chlorostyrene were obtained. *(In Russian.)* Issledovanie vliianiia davleniia na sposobnost' k polimerizatsii zameshchennykh v iadre α-metilstirolov. II. Orto-zameshchennye α-metilstiroly. ***V. V. Korshak, A. M. Poliakova, and I. M. Stoletova.*** *Akademiia Nauk SSSR, Izvestiia, Otdelenie Khimicheskikh Nauk*, 1959, no. 8, Aug., p. 1477-1479.

1043* The Polymerization of 1,3-Cyclohexadiene. The polymerization of pure 1,3-cyclohexadiene in the presence of $TiCl_4$ was carried out in C_2H_5Cl, $C_2H_4Cl_2$, $CHCl_3$, CCl_4, and petroleum ether, and a polymer with a molecular weight of the order 500-4300 was hereby obtained. The yield of the polymer increases in general with the concentration increase of $TiCl_4$. The polymer contains Cl in all cases. *(In Russian.)* O polimerizatsii tsiklogeksadiena-1.3. ***B. V. Erofeev, et al.*** *Akademiia Navuk Belaruskaia SSR, Doklady*, v. 3, no. 3, Mar. 1959, p. 95-99.

1044* The Construction and Long Term Performance of Polyester/Glass Fibre Sectional Tanks Under Various Environments. ***A. W. Rawe.*** *Applied Plastics*, v. 2, Sept. 1959, p. 45-50.

1045 Epoxide Resin Systems for Encapsulating Large Electrical Components. ***G. J. Powell and R. E. Stolton.*** *British Plastics*, v. 32, Aug. 1959, p. 380-383.

1046 Plastics in Ships. The shipbuilding industry is continually searching for new means of overcoming corrosion hazards and reducing topweight. All uses described in this article are to be seen in ships in service or under construction. *British Plastics*, v. 32, Sept. 1959, p. 402-409.

1047 Epoxides in Slip Ring and Commutator Assemblies. *British Plastics*, v. 32, Sept. 1959, p. 414-416.

1048 Preplasticizing in Injection Moulding. I. The Principles of Preplasticizing and the History of Its Development. Requirements leading to the design of preplasticizing machines are discussed and a short history of the development of the principle is given. ***E. G. Fisher and W. A. Maslen.*** *British Plastics*, v. 32, Sept. 1959, p. 417-424.

1049 Foam Produces Improved Insulation. Wyandotte's urethane foam containing fluorinated hydrocarbon gas cuts heat losses, saves labor. *Chemical and Engineering News*, v. 37, no. 38, Sept. 21, 1959, p. 56.

1050 Plastics for Protection Against Corrosion. Paper outlines the various ways in which plastics are used, especially in the chemical industry, for protection against corrosion. ***A. C. Docherty and H. Hughes.*** *Chemistry & Industry*, 1959, no. 38, Sept. 19, p. 1171-1179.

1051 Effects of Gamma Radiation at 25 C on Silicone Dielectrics. To obtain radiation-effects data on one group of dielectrics, measurements of effects of γ-radiation on physical and dielectric properties of liquid, semi-solid, elastomeric, and resinous silicones are being made. These measurements indicate that many silicone dielectrics have appreciable resistance to radiation exposure. ***C. G. Currin.*** *Communication and Electronics*, 1959, no. 44, Sept., p. 297-308.

1052* Molded DAP Resins in Weapons-System Components Design. Diallyl phthalate molding compounds offer high electrical and mechanical properties. Typical properties of several types of filled DAP resins are given. *Electrical Manufacturing*, v. 64, Oct. 1959, p. 180-182.

1053 Radiation-Cross Linking of Plasticized Poly-(vinyl Chloride). Addition of small amounts of a tetrafunctional monomer to plasticized PVC permits a controlled cross linking (vulcanization) by low doses of ionizing radiation without decomposition. Application of this cross-linking process to diverse PVC formulations may extend the range of properties and uses for these materials. ***A. A. Miller.*** *Industrial and Engineering Chemistry*, v. 51, Oct. 1959, p. 1271-1274.

1054 Mechanical Degradation of Polyisobutylene Solutions. A discussion of the degradation of polymer to measurable parameters in order to elucidate the theory of solution degradation, and to point the way to its control. ***Ferdinand Rodriguez and Charles C. Winding.*** *Industrial and Engineering Chemistry*, v. 51, Oct. 1959, p. 1281-1284.

1055* Resistance to Thermal Embrittlement and Hydrolysis Improved With Isocyanate Treatment for Mylar Polyester Film. Effect of the treatments on brittle life, tensile strength, and elongation were determined by aging tests at 160, 180, and 210 C. Hydrolytic stability, water absorption, weight gain due to the treatment, and weight loss on heating at 180 C were also determined. ***Max M. Lee and R. D. Hodges.*** *Insulation*, v. 5, Oct. 1959, p. 18-26.

1056 Preparation and Polymerization of *p*-Vinylphenol. Successful direct synthesis of *p*-vinylphenol by the decarboxylation of *p*-hydroxycinnamic acid. ***Richard C. Sovish.*** *Journal of Organic Chemistry*, v. 24, Sept. 1959, p. 1345-1347.

1057 High Energy γ-Irradiation of Vinyl Monomers. I. Radiation Polymerization of Acrylonitrile. Acrylonitrile monomer, in the presence of water and N,N-dimethylformamide, was exposed to high energy γ-radiation from cobalt-60 and high dose rates ranging from 1.21 to 5.44 x 10^{20} e.v./l./min. ***Jett C. Arthur, Jr., Robert J. Demint, and Robert A. Pittman.*** *Journal of Physical Chemistry*, v. 63, Sept. 1959, p. 1366-1368.

1058 Sonic Degradation of High Polymers in Solution. Rates of sonic degradation of polymethyl methacrylate, polyisobutene, polylauryl methacrylate, and polystyrene are deter-

mined by use of 2,2-diphenyl-1-picryl hydrazyl to measure free radical fragments. ***J. R. Thomas.*** *Journal of Physical Chemistry,* v. 63, Oct. 1959, p. 1725-1729.

1059 Radiation Chemistry of Polyvinyl Chloride. Polyvinyl chloride, $-CH_2CH(Cl)-$, was irradiated with high-energy electrons. Radiation yields for HCl were determined as a function of temperature. Post-irradiation changes *in vacuo* and in air were measured by electron paramagnetic resonance and by visual observation of color. ***A. A. Miller.*** *Journal of Physical Chemistry,* v. 63, Oct. 1959, p. 1755-1759.

1060* Endgroups in Tetrafluoroethylene Polymers. Aqueous polymerization of tetrafluoroethylene initiated with ammonium persulfate in neutral or relatively weak acid solutions leads to polymer containing carboxyl end groups. The conversion of this end group to the Na salt and its pyrolysis to the terminal olefin was followed, using infrared absorption technique. ***M. I. Bro and C. A. Sperati.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 289-295.

1061* The Spreading of Liquids on Polyethylene Film. The Effect of Preprinting Treatments. A study of the wettability of thin films of polyethylene by observing the equilibrium advancing contact angle formed by a drop of liquid on the surface. ***A. J. G. Allan.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 297-306.

1062* Interpolyesters Containing Pinic and Homopinic Acids. Polyethylene pinate-4,4′-biphenyldicarboxylate, polyethylene homopinate-4,4′-biphenyldicarboxylate, and polyethylene pinate-terephthalate interpolymers were all prepared on a laboratory scale by ester-interchange reactions. The polymer, fiber and film-forming properties were examined. ***Edward A. Wielicki, et al.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 307-318.

1063* The Photolysis of Polyethylene Terephthalate. Rate of polymer bond rupture was measured by the change in molecular weight. The rate of energy absorption upon exposure to near ultraviolet light was determined from an analysis of the emission characteristics of the light sources used and the absorption characteristics of the polymer. ***K. R. Osborn.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 357-367.

1064* The Polymerization of Acrylamide Initiated by Ceric Nitrate—3-Chloro-1-Propanol Redox Systems. A kinetic scheme is proposed whereby ceric ions are responsible for both initiation and termination. ***G. Mino, S. Kaizerman, and E. Rasmussen.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 393-401.

1065* Polymerization of Triallyl Cyanurate-Polyester Resins. Differential thermal analysis data and infrared spectra are utilized to establish the mechanism by which a particular triallyl cyanurate-polyester (Vibrin 135) resin polymerizes. ***Dale E. German, Bert H. Clampitt, and Joseph R. Galli.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 433-440.

1066* The Infrared Spectrum of Polyethylene Terephthalate. I. The Effect of Crystallization. II. Polyethylene-d_4 Terephthalate. Films of amorphous polyethylene terephthalate were drawn and heated to various extents. Intensity changes of the infrared spectral bands resulting from these treatments were followed. ***Akihisa Miyake.*** *Journal of Polymer Science,* v. 38, Aug. 1959, p. 479-512.

1067* Weathering Resistance of Plasticized PVC Compounds for Cables and Electrical Engineering. Plasticized PVC sheet was exposed to natural weathering over a period of eight years. Resultant embrittlement was investigated mainly by the sensitive low temperature impact strength. It is shown to what extent the individual components influence the effect of weathering. *(In German.)* Wetterbeständigkeit von weichgemachten PVC-Massen für die Kabelund Leitungstechnik. ***W. Birnthaler and G. Falk.*** *Kunststoffe,* v. 49, Sept. 1959, p. 439-446.

1068* Vestolit SB 70 — A New PVC Paste Polymer. Vestolit SB 70 is especially suitable for production of PVC pastes. New resin contains very little emulsifier, is less susceptible to influence of water, and produces pastes of lower viscosity. Properties and methods of processing are discussed. *(In German.)* Ein neues PVC für Plastisole Vestolit SB 70. ***Georg Wick and Gerhard Weber.*** *Kunststoffe,* v. 49, Sept. 1959, p. 455-459.

1069 Acrolein Polymers. XIV. The Polymerization and the Graft-Mixed-Polymerization of Acrolein Under the Effect of Co-60-Gamma Ray. *(In German.)* Polymere Acroleine. XIV. Die Polymerisation und Pfropf-Mischpolymerisation des Acroleins unter dem Einfluss von Co-60-Gamma-Strahlen. ***Arnim Henglein, Wolfram Schnabel, and Rolf C. Schulz.*** *Makromolekulare Chemie,* v. 31, nos. 2-3, June 1959, p. 181-191.

1070* Catalytic Reactivity of Organometallic Compounds for Olefin Polymerization. IV. Vinyl Polymerization by Organocalcium Compound. Calcium zinctetraethyl complex, $CaZn(C_2H_5)_4$, induces the polymerization of some vinyl compounds such as styrene, methyl methacrylate, and acrylonitrile. ***Shohei Inoue, Teiji Tsuruta, and Junji Furukawa.*** *Makromolekulare Chemie,* v. 32, nos. 2-3, Aug. 1959, p. 97-111.

1071* The Polymerisation of Styrene by Solid Catalysts Derived From the Reaction of Titanium IV Compounds With Grignard Reagents. Solid catalysts, prepared by treating alkyl or aryl magnesium halides with $TiCl_4$ or butyl o-titanate, polymerize styrene rapidly to amorphous low molecular weight (10^4-10^5) polymer. The energy of activation for the process is approximately 20 kcal/mole for all active catalysts. Kinetic evidence indicates that initiation and propagation proceed by insertion of monomer molecules at a metal-carbon bond and that termination is spontaneous. ***P. E. M. Allen and J. F. Harrod.*** *Makromolekulare Chemie,* v. 32, nos. 2-3, Aug. 1959, p. 153-169.

1072* Acrolein Polymers. XV. Investigations of the Emulsion Polymerization of Acrolein. Solution of polyacrolein in aqueous SO_2 is an excellent emulsifier for the emulsion polymerization of acrolein with redox systems. The influence of the concentration of emulsifier, initiator, and monomer, and also of the temperature has been studied. *(In German.)* Polymere Acroleine. XV. Untersuchungen über die Emulsionspolymerisation des Acroleins. ***Harald Cherdron, Rolf C. Schulz, and Werner Kern.*** *Makromolekulare Chemie,* v. 32, nos. 2-3, Aug. 1959, p. 197-208.

1073 How the New Propellants Affect Plastics and Elastomers. Graphs show quantitatively the effects of the new storable missile propellants on properties of usable elastomers and plastics. ***R. E. Mowers.*** *Materials in Design Engineering,* v. 50, Sept. 1959, p. 89-91.

1074 New Reinforced TFE Plastics Resist Cold Flow. Offer chemical inertness, low ablation, low friction, and good electrical properties. The secret: a highly uniform blend of resin and inorganic fiber achieved by the beater addition process. ***Norman L. Greenman.*** *Materials in Design Engineering,* v. 50, Oct. 1959, p. 98-101.

1075 What About Flame Resistance in Plastics? Rundown on the codes, regulations, tests, and standards that the plastics industries face—plus the problems involved in making plastics self-extinguishing. *Modern Plastics,* v. 37, no. 1, Sept. 1959, p. 81 + 7 pages.

1076 Effectiveness of Coupling Agents in Glass-Reinforced Plastics. Laminates prepared with an epoxy resin, a polyester, and a polybutadiene-type resin, in which the coupling agent is (1) omitted, (2) added in resin solution, and (3) applied to the glass surface. ***Byron M. Vanderbilt.*** *Modern Plastics,* v. 37, no. 1, Sept. 1959, p. 125 + 6 pages.

1077 Ethylene-Butene Copolymer Resins. Ethylene-butene copolymer resins now available combine high stiffness and toughness, excellent stress-cracking resistance, and superior performance under long-term loads. ***J. E. Pritchard, R. M. McGlamery, and P. J. Boeke.*** *Modern Plastics,* v. 37, no. 2, Oct. 1959, p. 132 + 5 pages.

1078 Epoxidized Polyolefin Resins. A20 epoxy resins are epoxidized polyolefins which can be cured at room temperature with dibasic acid and anhydride curing agents. High flexural strengths and heat distortion temperatures, and superior age resistance are exhibited by the resin when cured with maleic anhydride and aliphatic polyols. ***Frank P. Greenspan, Chris***

Johnston, and Murray Reich. *Modern Plastics*, v. 37, no. 2, Oct. 1959, p. 142 + 3 pages.

1079 Modern Plastics Encyclopedia Issue for 1960. Resins and molding compounds; foamed plastics; chemicals and additives; film, sheeting, and shapes; fillers and reinforcements; laminates and reinforced plastics; engineering and methods; fabricating and finishing; machinery and equipment; directory. *Modern Plastics (Encyclopedia Issue*, 1960), v. 37, no. 1A, Sept. 1959, 1236 pp.

1080* Experimental Approach to the Production of Applicable Boron Polymers. Systematic study of certain linkages which might be thermally stable and lead to the development of temperature-resistant polymers. ***W. Gerrard.*** *Oil & Colour Chemists' Association, Journal*, v. 42, Sept. 1959, p. 625-643.

1081 The Physical Properties of Polymers. Comprising papers read at the Silver Jubilee Symposium organized by the Plastics and Polymers Group held in the University of London. Structure, physical, electrical, and mechanical properties of polymers. 293 pp. 1959. MacMillan, New York. (TA455.P7 So13p)

1082* Examining the Heat-Distortion Behavior of Plastics. Improved apparatus for testing heat-distortion temperatures of plastic materials is described. ***R. Van Cleve and R. R. Cosner.*** *Plastics Technology*, v. 5, Sept. 1959, p. 60-64.

1083* Thermoforming Biaxially-Oriented Film and Sheet. Variables in the forming operations are described, together with some of the recent equipment and package design developments. ***J. L. Murphy,*** *Plastics Technology*, v. 5, Oct. 1959, p. 42-44.

1084* Effects of Molding Variables on Reinforced-Plastic Products. Results of a definitive test program on glass-polyester parts made in matched-metal molds. ***T. H. Beals, T. C. Tan, and C. B. Sias.*** *Plastics Technology*, v. 5, Oct. 1959, p. 45-52.

1085 What Fillers Will Do for the Latest Teflon. Teflon 100X FEP-fluorocarbon resin is a fluorinated ethylene-propylene polymer. In properties it is very similar to the older Teflon-TFE; however the 100X resin, unlike TFE types, can be molded and extruded pretty much like other thermoplastics. Filled 100X can be compression- and injection-molded, but extruded only at slow rates. ***W. B. Watkins.*** *Product Engineering*, v. 30, no. 40, Sept. 28, 1959, p. 52-53.

1086 Flame-Retardant Polyethylene for Wire and Cable. Loadings on polyethylene up to 36% with proper ratios of chlorinated paraffin to Sb_2O_3 produce wire coating compounds meeting the desired levels of flame retardancy. ***R. C. Graham and C. A. Neros.*** *Rubber and Plastics Age*, v. 40, Aug. 1959, p. 842 + 3 pages.

1087* Stabilization of Mixtures Containing Polyvinyl Chloride. Effectiveness of oxygenation in PVC discoloration; suggests how these oxygenated groups originate, and relates the presence of these color bodies to the presence of Zn and Cd. ***C. H. Fuchsman.*** *SPE Journal*, v. 15, Sept. 1959, p. 787-790.

1088* Creep Behavior of Transparent Plastics at Elevated Temperatures. Results of experiments designed to measure creep elongation of plastics exposed to temperature differentials and biaxial stresses. Article points the way towards defining temperature limitations for plastics being considered or now used as aircraft glazing, such as canopies. ***Frank L. McCrackin and Charles F. Bersch.*** *SPE Journal*, v. 15, Sept. 1959, p. 791-796.

1089* An Easy Way to Control Cure of Polyester Resins. Method is based on use of two types of graphs, with detailed steps given on how to obtain data for construction of these graphs. These steps may be used to obtain similar information for any other similar resin. ***James M. Smith and Robert B. Bennett.*** *SPE Journal*, v. 15, Oct. 1959, p. 867-872.

1090* Interfacial Properties of Polyesters at Glass and Water Surfaces. Fundamental properties of adhesion applicable to resin-glass fiber systems in reinforced plastics. ***Robert R. Stromberg, Wendell M. Lee, and Alan R. Quasius.*** *SPE Journal*, v. 15, Oct. 1959, p. 883-886.

1091 Techniques of Polymer Characterization. Fractionation of high polymers. Number-average molecular weights by osmometry. Other methods for the determination of number-average molecular weights. Light-scattering techniques. Viscometry. Techniques of end-group analysis. The characterization of block and graft copolymers. ***P. W. Allen, editor.*** 256 pp. 1959. Academic Press, New York. (QD471 AL54t)

1092* On the Condensation Telemerization and Synthesis of a New Type of Unsaturated Polyesters. It has been shown that control of chain growth in polyesterification may be used to direct the synthesis of oligomeric polyesters containing reactive end groups. Utilizing methacrylic (or acrylic) acid as regulator of the polyesterification process, polyesteracrylates, representative of a new class of unsaturated polyesters capable of polymerization, have been synthesized and described. *(In Russian.)* O kondensatsionnoĭ telomerizatsii i sinteze novogo tipa nepredel'nykh poliefirov. ***A. A. Berlin, G. L. Popova, and E. F. Isaeva.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 7, July 1959, p. 951-956.

1093* The Use of Irradiated Polyethylene in Wire and Cable. Properties and applications. ***Allen N. Towne.*** *Wire and Wire Products*, v. 34, Oct. 1959, p. 1293 + 5 pages.

See also: **271** (polymer irradiation); **476** (the plasticizer market).

POLLUTION AND WASTES

1094* Sulfur Dioxide Furor. A discussion of the present knowledge of the part sulfur dioxide plays in the air-pollution problem. Although there is much conclusive evidence that plant damage and atmospheric corrosion can be traced to the presence of this compound in the air, effects on the health of the public is not at all clearly defined by the evidence at hand. ***W. L. Faith.*** *Industrial Wastes*, v. 4, no. 5, Sept. 1959, p. 89-90.

1095 Proceedings of the Thirteenth Industrial Waste Conference, May 5, 6, and 7, 1958. The contents include over 60 of the papers presented at this conference covering many phases of waste disposal. Industrial wastes specifically mentioned in titles are: pharmaceutical, poultry processing, sugar-beet refining, metal pickling, paper mill, tall oil purification, acid mine drainage, metal rolling, meat packing, petroleum refining, radioactive, and nylon manufacturing. *Purdue University, Industrial Waste Conference*, 13th Conference, 1958, 790 pp. (TD897 In2p Vis.)

1096 Catalytic Oxidation of Automobile Exhaust Gases—An Evaluation of the Houdry Catalyst. ***G. J. Nebel and R. W. Bishop.*** *Society of Automotive Engineers, Preprint* 29R, 1959, 21 pp.

1097 A Procedure for Estimating Capacity of a Ground Disposal Facility for Radioactive Waste. ***A. E. Reisenauer.*** *U. S. Atomic Energy Commission, HW*-57897, May 4, 1959, 16 pp. (UF767 Un3.1hw Contin.)

1098* Oxidation of Sewage Odors. . . . by means of catalytic oxidation. ***A. H. Ullrich and R. J. Ruff.*** *Water & Sewage Works*, v. 106, Sept. 1959, p. 395-397.

RUBBER AND ELASTOMERS

1099* The Deswelling Action of Hydrazine on Nitrile Rubber. ***Sven Sönnerskog.*** *Acta Chemica Scandinavica*, v. 13, no. 5, 1959, p. 1034-1035.

1100 Oxidation of Hevea Vulcanizates Containing Carbon Black. Oxidation by molecular O of a mixture of natural rubber and carbon black vulcanized with cumyl peroxide. ***E. M. Bevilacqua.*** *American Chemical Society, Journal*, v. 81, Oct. 5, 1959, p. 5071-5077.

1101 New Elastomers Containing Fluorine. The solvent resistance and low-temperature characteristics of these elastomers should make them useful in many applications. ***D. A. Barr, R. N. Haszeldine, and C. J. Willis.*** *Chemical Society, Proceedings*, 1959, Aug., p. 230.

1102 The Strain-Dependence of Rubber Visco-Elasticity. I. The Region of Moderate Strain. Method by which the strain dependence of each component of the dynamic Young's modulus may be represented at a given temperature and frequency by two parameters. Values of the modulus components for natural, butadiene-acrylonitrile, and butyl rubbers were derived from observations of the velocity and attenuation of 1 kc/sec longitudinal waves in filaments stretched by amounts up to 100%. ***P. Mason.*** *Faraday Society, Transactions*, v. 55, Aug. 1959, p. 1461-1469.

1103* *cis-trans* Isomerization in Polyisoprenes. III. Reduction in the Rate of Crystallization of Natural Rubber at Low Temperatures by Treatment With Sulfur Dioxide. IV. Conversion of Gutta-Percha to a Polymer Which Is Rubber-Like at Room Temperature. *J. I. Cunneen and W. F. Watson.* *Journal of Polymer Science*, v. 38, Aug. 1959, p. 521-538.

1104* The Synthesis of *trans*-1,4-Polyisoprene. A polymer containing up to 97% of links of the *trans*-1,4 form was obtained on catalytic polymerization of isoprene with the aid of triethyl aluminum and $TiCl_4$. (*In Russian.*) Sintez *trans*-1,4-poliizoprena. ***A. M. Vladimirov, L. A. Gavrilova, and V. A. Krol'.*** *Kauchuk i Rezina*, v. 18, no. 7, July 1959, p. 6-7.

1105* The Properties of Mixtures and of Vulcanized Rubbers on the Basis of Bromobutyl Rubbers. The basic properties of USSR-produced bromobutyl rubber are compared with those of imported rubber. (*In Russian.*) Svoĭstva smeseĭ i vulkanizatov no osnove brombutilkauchuka. ***K. F. Kaluzhenina, S. K. Zherebkov, T. M. Sukhotina, and V. S. Sergeicheva.*** *Kauchuk i Rezina*, v. 18, no. 7, July 1959, p. 13-18.

1106* Metal Fluorides Used as Fillers for Fluorine Copolymer Rubber. Calcium, Mg, Sr, and Al fluorides are active fillers of rubber containing F. They are less active than powdered silica gel, but guarantee a higher heat stability of rubber. Calcium and Mg fillers are the most active. (*In Russian.*) Ftoridy metallov - napolniteli dlia rezin iz ftorsopolimerov. ***F. A. Galil-Ogly, I. A. Skuba, and A. S. Novikov.*** *Kauchuk i Rezina*, v. 18, no. 7, July 1959, p. 31-36.

1107* Vulcanization of High Elastic Polymers. XXVI. Vulcanization of Natural and Synthetic Rubbers With Sulfur in the Presence of Organic Bases. II. In the vulcanization of Perbunan N 2818 accelerated by diphenylguanidine the S decrease is independent of temperature and occurs at all concentrations of accelerator and S. The dependence of initial rate on initial concentration is of no reaction order in the usual sense, which is due to interference by an intermediate compound. (*In German.*) Zur Kenntnis der Vulkanisation hochelastischer Polymerisate. XXVI. Die Vulkanisation von Naturkautschuk und synthetischen Kautschuken durch Schwefel in Anwesenheit organischer Basen. II. ***Walter Scheele and Wolfgang Redetzky.*** *Kautschuk und Gummi*, v. 12, no. 8, Aug. 1959, p. WT205-WT211.

1108 Solid Urethane Elastomers. Details on six well-engineered commercial uses and on properties obtainable. ***Malcolm W. Riley.*** *Materials in Design Engineering*, v. 50, Oct. 1959, p. 92-97.

1109* Comparisons of Antioxidant-Antiozonant Activities of Some Protective Agents. The best antiozonants in the p-phenylenediamine series are the least active as antioxidants, and the best antioxidants are the least active as antiozonants. Antioxidant and antiozonant mechanisms are completely different and pursue widely different paths. For any given compound, high activity against one of the degradative factors, oxygen or ozone, appears to mitigate against high activity against the other factor. ***J. H. Thelin and A. R. Davis.*** *Rubber Age*, v. 86, no. 1, Oct. 1959, p. 81-85.

1110* Butyl Rubber Latex: Its Uses in Non-Transport Applications. MD-600-55, an anionically emulsified latex of Enjay Butyl 268, makes butyl rubber available in a high solids true latex form for the first time. Properties and applications are discussed. ***A. L. Miller and K. W. Powers.*** *Rubber Age*, v. 86, no. 1, Oct. 1959, p. 89-95.

1111* Vulcanisation of Butadiene—Styrene Rubber by Gamma Irradiation. Vulcanization of butadiene-styrene rubber with γ-rays, particular emphasis being placed on the mechanical and aging properties of practical tire tread type vulcanizates, and on simple methods for improving the cross-link yields of the vulcanizates by means of heavy metal fillers. ***P. M. Arnold, Gerard Kraus, and H. R. Anderson, Jr.*** *Rubber and Plastics Age*, v. 40, Aug. 1959, p. 836-839.

1112* Synthetic Rubbers in Cables. VI. Silicone Rubber and Miscellaneous Types. Uses; choice of material; processing; mechanical and electrical properties. ***W. S. Penn.*** *Rubber Journal and International Plastics*, v. 137, no. 7, Sept. 26, 1959, p. 242 + 2 pages.

1113* Wing-Stay 100 as an Antiozonant. Wing-Stay 100, which is a mixture of diaryl-p-phenylenediamines, was evaluated as to its effectiveness as a protective agent for SBR polymers against ozone. Tests in the laboratory plus tire road tests indicate that this chemical, having low volatility and low oxidation rate, exhibits considerable persistence and relatively long lasting protection. ***J. C. Ambelang and B. W. Habeck.*** *Rubber World*, v. 141, no. 1, Oct. 1959, p. 86 + 11 pages.

1114* Effect of Temperature and Degree of Crosslinkage on the Frictional Properties of Rubber-Type Elastomers. An investigation into the effect of temperature, type of rubber hydrocarbon, and equilibrium modulus of the vulcanized rubber on the frictional properties of elastomers. External friction of elastomers is a molecular-kinetic process connected with passage through energy barriers under the influence of thermal motion and external force of chains interlinked with the solid surface. (*In Russian.*) Vliianie na friktsionnye svoĭstva kauchukopodobnykh polimerov tipa kauchuka, stepeni poperechnogo sshivaniia i temperatury. ***G. M. Bartenev and Z. E. Styran.*** *Vysokomolekuliarnye Soedineniia*, v. 1, no. 7, July 1959, p. 978-989.

See also: **143** (determination of N in polymers); **302** (polymer adsorption by carbon black); **819** (silicone insulation); **1081** (properties of rubber).

SPACE HEATING AND CONDITIONING

1115* Electric Heating Puts on the Heat. The heating of the future is moving in today on the big excess capacities of electric power built up by summer air conditioning. ***Lawrence Lessing.*** *Architectural Forum*, v. 111, no. 4, Oct. 1959, p. 169 + 6 pages.

1116 Balanced Design in Electrostatic Precipitation. ***R. L. Chamberlain.*** *Blast Furnace and Steel Plant*, v. 47, Oct. 1959, p. 1086-1089.

1117* HTHW District Heating at the U. S. Air Force Academy. How and why High Temperature Hot Water district heating was applied to achieve low capital and operating costs. ***E. G. Hansen.*** *Combustion*, v. 31, no .3, Sept. 1959, p. 40-47.

1118* This Ion Business. Demonstrates beneficial effects of adding negative ions to the air. ***Frank R. Innes.*** *Electric Heat and Airconditioning*, v. 5, no. 5, Sept.-Oct. 1959, p. 26-27.

1119* Similarity Criteria of the Thermodynamic Properties of Refrigerants. The minimum number of criteria incorporating the properties of all others must not be less than two. Determination of the most important properties of substances is possible with the aid of only two experimental values on the vapor pressure curve (for 1 atm. and for the critical point). (*In Russian.*) Kriterii podobiia termodinamicheskikh svoĭstv kholodil'nykh agentov. ***I. S. Badyl'kes.*** *Kholodil'naia Tekhnika*, v. 36, no. 4, July-Aug. 1959, p. 10-14.

1120 Reaction of People to Exterior Aircraft Noise. ***Leo L. Beranek, Karl D. Kryter, and Laymon N. Miller.*** *Noise Control*, v. 5, Sept. 1959, p. 23 + 9 pages.

1121 Performance of Water Source Heat Pump for Office Building in Southwest. *F. L. McFadden, Jr.* Paper from "Symposium Session on Heat Pump Performance", p. 3-6, 1959. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, New York. (TJ266 Am35s)

1122 Performance of Water Source Heat Pumps in the Pacific Northwest. ***J. Donald Kroeker.*** Paper from "Symposium Session on Heat Pump Performance", p. 7-12, 1959. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, New York. (TJ266 Am35s)

1123 Performance of Packaged Air Source Heat Pump Units. ***W. A. Spofford.*** Paper from "Symposium Session on Heat Pump Performance", p. 12-17, 1959. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, New York. (TJ266 Am35s)

1124 Operation of Large Air Source Central Heat Pump Systems. ***E. R. Ambrose.*** Paper from "Symposium Session on Heat Pump Performance", p. 18-22, 1959. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, New York. (TJ266 Am35s)

1125 Performance of an Air Source Compound Heat Pump. ***A. D. Spillman.*** Paper from "Symposium Session on Heat Pump Performance", p. 23-27, 1959. American Society of Heating, Refrigerating, and Air-Conditioning Engineers, New York. (TJ266 Am35s)

TEXTILES, FIBERS, LEATHER, AND PAPER

1126* The Digestion of Wool by a Keratinolytic Bacillus. The occurrence, isolation, and characteristics of an aerobic, mesophilic, spore-forming bacillus capable of separating wool and hair into their constituent cuticular and cortical cells are described. ***G. S. Molyneux.*** *Australian Journal of Biological Sciences,* v. 12, no. 3, Aug. 1959, p. 274-281.

1127* Effect of Lamination Thickness on Strength of Curved Laminated Beams. The strength of straight, white oak laminates is not significantly affected by individual lamination thickness. Lamination thicknesses ranging from ¼ to ¾ inch have no significant effect on the strength of white oak beams laminated to curvatures no sharper than 72 inches, when loads are applied to a general radial direction to the convex faces of the beams. ***W. J. Finnorn and A. Rapavi.*** *Forest Products Journal,* v. 9, Aug. 1959, p. 248-251.

1128* Pulp in Pellets—A New Process. . . . tested in U. S. A. and Australia, makes possible bulk material handling, lower investment, lower shipping and handling cost. ***R. E. Shook.*** *Pulp and Paper,* v. 33, Oct. 1959, p. 70-72.

1129* Spruce and Balsam Bark as a Source of Fibre Products. Mixtures of spruce and balsam fir bark, as obtained from the drum barker of a local pulp mill, can be fiberized with conventional equipment after the removal of slime matter. This material can be removed from the bark with the aid of a screw extruder. Pulps prepared from treated barks have freeness values ranging from 500 to 700 ml. Canadian Standard. Hardboards and insulation boards prepared from these bark pulps meet specifications for certain classes of board. Particle boards prepared from extruded, non-fiberized bark, and using an inexpensive experimental binder material, show some promise. ***F. Bender.*** *Pulp and Paper Magazine of Canada,* v. 60, Sept. 1959, p. T275-T278.

1130* Effective Microorganism Control Program. . . . in paper and pulp mill systems. ***J. J. Dietzel and C. P. Kirchen.*** *Tappi,* v. 42, Aug. 1959, p. 176A-178A.

1131* Physical and Anatomical Characteristics of Hardwoods. Explains the anatomical basis of the technological properties of wood, and equates variations in cell structure of hardwoods with variation in specific gravity of wood. The paper discusses the anatomical basis of shrinkage and swelling of wood in the submicroscopic structure of the walls of the wood fibers that determine the direction of the grain. ***J. D. Hale.*** *Tappi,* v. 42, Aug. 1959, p. 670-677.

1132* Improvement of Hardwoods Through Genetics. Discussion focuses primarily upon the conditioning effect which genetic differences of trees may have upon those properties of wood which are of particular importance to the pulp, paper, and paperboard industry. ***Philip N. Joranson.*** *Tappi,* v. 42, Aug. 1959, p. 691-700.

1133 A Critical Assessment of Recent Progress in the Technology of Cotton Spinning. A description is given of the machinery developments which, in the post-war years, have led to higher drafts, larger packages, and higher machine speeds. The importance of fiber arrangement and sliver regularity is examined, and the effect on subsequent processing in carded and combed qualities and also in sliver-to-yarn spinning is discussed. Comments are made on modern developments in ring spinning whereby higher speeds are attainable. ***W. Nutter and W. Slater.*** *Textile Institute, Journal, Proceedings,* v. 50, Aug. 1959, p. 397-428.

1134 List of Publications on the Growth, Structure, and Identification of Wood. Includes publications that give general information and the results of research by the U. S. Forest Service on the structure and the identification of wood; the effect of the cellular structure of wood on its strength, shrinkage, permeability, and other properties; the influence of environmental factors, such as light, soil, moisture, and fire, on the quality of wood produced; and secretions of economic value produced by trees and their exploitation. *U. S. Forest Products Laboratory Report No.* 177, Apr. 1959, 31 pp. (TS800 Un3.3r Contin.)

1135 List of Publications on Mechanical Properties and Structural Uses of Wood and Wood Products. *U. S. Forest Products Laboratory Report No.* 200, Feb. 1959, 65 pp. (TS800 Un3.3r Contin.)

1136 Estimating Tree Specific Gravity From a Single Increment Core. Regression equations have been worked out for estimating tree specific gravity of longleaf, slash, loblolly, and shortleaf pines. ***Harold E. Wahlgren and Donald L. Fassnacht.*** *U. S. Forest Products Laboratory Report No.* 2146, Apr. 1959, 24 pp. (TS800 Un3.3r Contin.)

See also: **479** (Communist pulp and paper industry).

WELDING AND JOINING

1137* Technical Measures to Increase the Vibration Resistance of Welded Joints. In order to increase the vibration resistance, an electrode wire with high Mn content in automatic welding, and electrodes with a rod of the same wire in hand-welding, must be used. (*In Russian.*) Nekotorye tekhnologicheskie mery povysheniia vibratsionnoĭ prochnosti svarnykh soedineniĭ. ***A. E. Asnis.*** *Avtomaticheskaia Svarka,* v. 12, no. 9, Sept. 1959, p. 17-25.

1138 Strength of Components Repaired by Welding. Considers the effect of different types of weld on the fatigue resistance of engineering components made of mild steel or of high-tensile steel. Explains how fatigue failure may occur owing to the incorrect application of welding. ***S. Wise.*** *British Welding Journal,* v. 6, Aug. 1959, p. 345-350.

1139 Reclamation of a 30-Ton Steel Casting. Reports the method employed to salvage a 30-ton cast steel drop hammer frame, which was considered to be beyond repair. ***G. Gordon Musted.*** *British Welding Journal,* v. 6, Aug. 1959, p. 351-353.

1140 Reproducibility of the CTS Weldability Test for Low-Alloy Steels. Cooperative investigation by five laboratories on the Controlled Thermal Severity Test, which has been chosen by Sub-Commission B of Commission IX of the International Institute of Welding as the most reliable basis for determining weldability of low-alloy steels. *British Welding Journal,* v. 6, Aug. 1959, p. 354-361.

1141 Further Tests on Welded Connections Between I-Section Beams and Stanchions. Economical design of welded beam-to-stanchion rigid connections for multi-story steel frames fabricated from material to BS.15. ***L. G. Johnson.*** *British Welding Journal,* v. 6, Aug. 1959, p. 367-373.

1142* Retaining Rings. *Design News,* v. 14, Oct. 12, 1959, p. 30-31.

1143 Welding of Molybdenum. Welding techniques and problems involved are described for commercial arc-cast Mo whose main disadvantages are lack of O resistance and brittleness. Joining techniques reported are controlled-atmosphere (preferred), shielded welding cup, gas shielded-consumable electrode, submerged-arc, and resistance welding. Control of grain growth is stressed. ***D. C. Martin.*** Paper from "Fabrication of Molybdenum", p. 63-76, 1959. American Society for Metals, Cleveland. (TN799.M7 Am35.5f)

1144 Maintenance Applications of Welding. Discusses problems encountered and costs involved in maintenance welding. ***R. J. Osborn.*** *Iron and Steel Engineer*, v. 36, Sept. 1959, p. 107-116.

1145 Bonding Rare Metals. What tests show about tensile strengths of adhesive bonds between uncommon metals. ***R. F. Wegman and M. J. Bodnar.*** *Machine Design*, v. 31, Oct. 1, 1959, p. 139-140.

1146 Adhesive Bonding. A complete manual on the specifications and uses of bonding adhesives, and the design of adhesive bonded joints. ***Jack C. Merriam.*** *Materials in Design Engineering*, v. 50, Sept. 1959, p. 111-128.

1147 Electric Arc Welding. Summary of proceedings at Birmingham University conference held on June 25, 1959. *Metal Industry*, v. 95, Sept. 18, 1959, p. 120-121.

1148 Brazing Aluminium Alloys. I. Principles. *Metal Industry*, v. 95, Sept. 25, 1959, p. 135-138.

1149* Fabrication Techniques for Tantalum. New methods for producing Ta make it possible to obtain larger ingots and therefore larger sheets. New welding techniques have solved some major fabrication problems. ***Burton Payne.*** *Metalworking Production*, v. 103, no. 39, Sept. 25, 1959, p. 1514-1516.

1150 Electron Beam Welding—New Joining Process for the Nuclear Age. Joining of reactive and refractory metals such as Ta, U, Zr, Ti, and Be has received great impetus from electron beam welding. It prevents introduction of impurities and permits precision control of heat input. *Modern Assembly Practice*, 1959, Sept., p. 9-10.

1151* Adhesives for Laminating Aluminum Foil. II. A guide to adhesive selection for three bonding methods—dry, wet, and hot-melt. *Paper, Film and Foil Converter*, v. 33, Oct. 1959, p. 40-42.

1152* Experiments Dealing With the Friction Welding of Metals. Welding equipment, preliminary experiments with thermoplastic P.V.C. (hard), measurement of the friction moment welding experiments on Al pipes with flanges, determination of the strength of the joint. Friction welding of Al pipes, welding experiments with Cu. (*In German.*) Versuche zum Reibungsschweissen von Metallen. ***W. Hofmann and H. Schildwächter.*** *Schweissen und Schneiden*, v. 11, Sept. 1959, p. 349-352.

1153* Shielded Arc Welding of Aluminum Materials. Advantages of arc welding with inert gas protection as compared with autogenous welding, and of the use of He and A as compared with H. Base metal and filler metal welding properties. Time economy, protective measures, argon-arc method, shielded inert gas-metal arc method, and preparation of the welds. (*In German.*) Schutzgasschweissen der Aluminium-Werkstoffe. *Schweisstechnik*, v. 13, June 1959, p. 65-72.

1154 Prediction in New Metal Joining Processes. An important future trend will be for more application of automatic welding processes to reduce labor costs. ***John J. Chyle.*** *Society of Automotive Engineers, Preprint* 528, 1959, 33 pp.

1155 High Frequency Welding Speeds Mufflermaking. *Steel*, v. 145, Oct. 5, 1959, p. 105.

1156* Research on the Weldability of Heat Resisting 12% Steels. Under thermal welding cycle conditions, the zone around the seam of a welding compound of Cr-steel (12% Cr) was subjected to hardening with formation of brittle structures. In steels with no reinforcing alloy, the decrease of the cooling speed during welding caused a considerable increase of the grain and decreased plasticity. The hardening and grain growth tendency increase with increased C content. (*In Russian.*) Issledovanie svarivaemosti zharoprochnykh staleĭ s 12% khroma. ***M. Kh. Shorshorov, V. V. Belov, V. N. Zemsin, and I. D. Smirnova.*** *Svarochnoe Proizvodstvo*, 1959, no. 9, Sept., p. 6-10.

1157 Welding of Nickel-Molybdenum Alloys. Describes welding studies conducted on a commercial alloy, Hastelloy B, and a developmental alloy (now commercial), INOR-8. ***G. M. Slaughter, P. Patriarca, and R. E. Clausing.*** *U. S. Atomic Energy Commission, ORNL-2760*, Aug. 25, 1959, 32 pp. (UF767 U3o Contin.)

1158 Industrial Uses of Electroslag Welding in the Soviet Union. General problems are discussed because details apply to Russian products. ***E. Bishop.*** *Welding and Metal Fabrication*, v. 27, Aug.-Sept. 1959, p. 316-319.

1159 Development of a Transition Weld Between Ferritic and Austenitic Superheater Tubing. ***B. Löfblad and G. Lindh.*** *Welding and Metal Fabrication*, v. 27, Aug.-Sept. 1959, p. 325 + 6 pages.

1160 Joining Dissimilar Metals. II. Presents tables with recommended procedures for welding and brazing. ***J. G. Young and A. A. Smith.*** *Welding and Metal Fabrication*, v. 27, Aug.-Sept. 1959, p. 331-339.

1161* Will Brazed Molybdenum Replace the "Superalloys" in Jet Engine Parts? The successful application of Mo jet engine components will hinge on its ability to be brazed for high-temperature service. Brazing processes are discussed. ***G. S. Hoppin, III.*** *Welding Design & Fabrication*, v. 32, Sept. 1959, p. 46 + 4 pages.

1162 How to Weld Zirconium and Its Alloys. Zirconium is highly reactive to O and N, and since arc welding is recommended to retain this metal's highly desirable properties, particular steps necessary for properly joining this nuclear-age metal are listed. ***L. E. Stark.*** *Welding Engineer*, v. 44, Oct. 1959, p. 50-51.

1163 Resistance Spot-Welding of Tantalum Studied at Battelle. Although Tig welding is recommended for joining the reactive metals, studies are being conducted on the possible use of other welding processes. Micrographs of cross-sections of a typical weld showed some evidence of grain growth existing at interface, but in general grains did not appear to extend across faying plane. ***J. J. Vagi and R. L. Koppenhofer.*** *Welding Engineer*, v. 44, Oct. 1959, p. 52-53.

1164* Feasibility of Titanium for Welded Missiles. On a strength-weight basis, Ti offers attractive possibilities for use in rocket and missile casings. ***Carl E. Hartbower, George M. Orner, and Daniel M. Daley, Jr.*** *Welding Journal*, v. 38, Sept. 1959, p. 345s-353s.

1165* Spot Welding of a 12%-Cr Martensitic Stainless Steel. Optimum spot-welding conditions determined for 0.007-, 0.015- and 0.022-in. Type 422 modified stainless-steel sheet. ***E. F. Nippes, W. F. Savage, L. C. Ianniello, and W. A. Owczarski.*** *Welding Journal*, v. 38, Sept. 1959, p. 360s-366s.

1166* Development, Properties and Usability of Low-Hydrogen Electrodes. Interpretive report sponsored by the Welding Research Council reviews the development, properties, and use of low H electrodes. It reviews their history from the development of mild to ultrahigh-strength weld metal and the detrimental effects of moisture in the coverings on the weldment. ***D. C. Smith.*** *Welding Journal*, v. 38, Sept. 1959, p. 377s-392s.

1167* Maintaining Superior Weld Quality in a Plutonium Production Plant. Welding used to alter, improve, and maintain Hanford reactors and radio-chemical processing plants must have a quality of unquestioned reliability. ***C. D. Brons.*** *Welding Journal*, v. 38, Sept. 1959, p. 853-859.

1168* Use of Welding Simplifies the Design and Provides Economical Fabrication of New Welded-Steel Transfer Bridge for Loading Railroad-Car Floats. The use of welding simplified the design, and provided economical fabrication of a new railroad bridge structure in the reconstruction of a forty-year-old facility at Norfolk, Va. The design of the subject bridge girders incorporates several unusual details which are attained through the use of welding. ***M. L. Koehler.*** *Welding Journal*, v. 38, Sept. 1959, p. 860-864.

1169* Unitized Body Construction Developed by Automobile Manufacturer Leads to Major Design Changes, Engineering Advances and a New Set of Values in Transportation. There is an increase of approximately 300% in the number of welds required in the unitized body over separate-type construction. The welding industry has met this demand by developing time, heat and pressure controls that, through careful use and job application, have aided in producing a bonded or, perhaps, better described as a fused, body of remarkable strength. ***Karl M. Sims.*** *Welding Journal*, v. 38, Sept. 1959, p. 865-869.

1170* Plasma—A Substitute for the Oxy-Fuel Flame. Recent experience gained in the laboratory and from field tests indicates that the plasma torch offers tremendous advantages over conventional chemical flames for many welding applications. Not only can this new heat source, with its unusually high temperature, perform many tasks hitherto not possible, but it also produces unit heat output at lower than oxy-fuel costs when used on an industrial basis. ***James A. Browning.*** *Welding Journal*, v. 38, Sept. 1959, p. 870-875.

1171* Economies Effected in the Semiautomatic Welding of Piling. ***J. F. Gulley.*** *Welding Journal*, v. 38, Sept. 1959, p. 887-888.

1172* Welding of Nickel-Molybdenum Alloys. Alloys investigated were found to be readily weldable by the inert-gas-shielded W-arc process and to exhibit no difficulties with regard to cracking and porosity. ***G. M. Slaughter, P. Patriarca, and R. E. Clausing.*** *Welding Journal*, v. 38, Oct. 1959, p. 393S-400S.

1173* Electron-Beam Welding. Describes experimental results achieved by the initial development investigation and their applications. ***G. Burton, Jr. and Wm. L. Frankhouser.*** *Welding Journal*, v. 38, Oct. 1959, p. 401S-409S.

1174* The Principles of the Modern Arc Torch. Basic design, physical principles, and operational variables of the arc torch. ***R. M. Gage.*** *Welding Journal*, v. 38, Oct. 1959, p. 959-962.

1175* Ultrasonic Welding of Aluminum. Ultrasonic spot welds in foil and sheet-gage Al alloys exhibit strength equal to, or exceeding, similar resistance welds. Joining conditions are established for many commonly used Al alloys. ***F. R. Collins, J. D. Dowd, and M. W. Brennecke.*** *Welding Journal*, v. 38, Oct. 1959, p. 969-975.

1176* Dip-Transfer Carbon-Dioxide Welding. Significance of dynamic characteristic of power supply and its effects on results in low-current CO_2 gas-shielded consumable-electrode welding are discussed. ***Roger W. Tuthill.*** *Welding Journal*, v. 38, Oct. 1959, p. 976-981.

1177* A New System for Automatic Feedback Control of Resistance Spot Welding. Background analysis, design features and performance of the system are presented. ***G. R. Archer.*** *Welding Journal*, v. 38, Oct. 1959, p. 987-993.

See also: **774** (ultrasonic braze inspection).

MISCELLANEOUS

1178 Advanced Education—Past, Present, and Future. A brief historical review of education beyond the baccalaureate with particular emphasis on graduate study in electrical engineering is followed by an examination of present trends. ***Ferdinand Hamburger, Jr.*** *IRE Transactions on Education*, v. E-2, no. 2, Apr. 1959, p. 31-37. (TK1 In6.6ee Vis.)

1179 The Challenges in the Development of Graduate Programs. Traces the development of graduate engineering education from World War I, with its original attachment to the established pattern of graduate study in university science departments. Considers the place of research in graduate study and the problems arising from the need for research sponsorship today. ***Ernst Weber.*** *IRE Transactions on Education*, v. E-2, no. 2, Apr. 1959, p. 39-43. (TK1 In6.6ee Vis.)

1180 Advanced Education in Industry. Most companies in the electronics industry sponsor advanced education. They derive many benefits from the sponsorship of these programs, such as keeping their engineering staffs up to date on new technical advances, increasing the staff prestige, and attracting outstanding engineering graduates. ***James D. Cassidy.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 73-74. (TK1 In6.6ee Vis.)

1181 Undergraduate Laboratories—Some Comments on Efficient Use of Students' Time. Some sort of reportorial process is necessary for evaluation of undergraduate laboratory work. Process should accomplish its purpose with a minimum expenditure of time and effort and, wherever possible, enhance the educational efficiency of the laboratory. ***Walter J. Fahey.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 75-77. (TK1 In6.6ee Vis.)

1182 Criteria for the Selection of Engineers for Employment. Criteria must be more basic than the mere evaluation of personality, grades, and interests. ***Luke H. Noggle.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 78-81. (TK1 In6.6ee Vis.)

1183 1200 Case Studies of Engineering Motivation. Ability, motivation, work challenges, and environment set the pattern for a successful engineering career. Endeavors to develop a better understanding of these factors in order to assist young engineers in fulfilling their true potential. ***G. E. Moore.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 82-84. (TK1 In6.6ee Vis.)

1184 Understanding, Mathematics, and Scientific Education. States what the author believes is a good way to develop the powers of understanding of talented college science students. Makes a novel distinction between knowledge and understanding. Concludes that more schooling in mathematics is needed. ***William L. Kilmer.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 85-88. (TK1 In6.6ee Vis.)

1185 Dynamics of Engineering Education—Uniformity or Quality. Scientific reorientation of curricula vs. professional art of design as the principal requirement in engineering colleges. ***Ernst Weber.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 89-93. (TK1 In6.6ee Vis.)

1186 Success in Science or Engineering. Tests several hypotheses concerning the effects of family structure on an individual's personality development and its influence on his success in a science or engineering curriculum. ***Alexander G. Grasberg.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 94-103. (TK1 In6.6ee Vis.)

1187 Preliminary Studies in Automated Teaching. Teaching machines have proven to be dramatically effective in teaching a wide variety of subject matters. ***R. F. Mager.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 104-107. (TK1 In6.6ee Vis.)

1188 Industry's Contributions and Needs in Graduate Education. The reduction in time between the discovery of new knowledge and its application to fill human needs has demanded rapid sophistication of engineering and science graduates. Industry's need is graduate-study opportunity for its employees; its contribution is the integrated work-graduate study program. ***David F. Kline.*** *IRE Transactions on Education*, v. E-2, no. 3, June 1959, p. 108-109. (TK1 In6.6ee Vis.)

1189* Regular Products of Models. The conception of a regular product, which generalizes the conception of a direct product of models, is introduced. Theorems, particular cases of which are the Mostowski and the Vaught theorems about direct products of models, were proved for regular products. One individual form of model conformities, determined in this paper, is preliminarily discussed. (*In Russian.*) Reguliarnye Proizvedeniia Modeleĭ. ***A. I. Mal'tsev.*** *Akademiia Nauk SSSR, Izvestiia, Seriia Matematicheskaia*, v. 23, no. 4, July-Aug. 1959, p. 489-502.

1190* The Theorem of Universal Coefficients for the Group of Homologues of Group Complexes Without Torsion. *(In Russian.)* Teorema ob universal'nykh koeffitsientakh dlia grupp gomologiĭ gruppovykh kompleksov bez krucheniia.

M. F. Bokshtein. *Akademiia Nauk SSSR, Izvestiia, Seriia Matematicheskaia*, v. 23, no. 4, July-Aug. 1959, p. 529-564.

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1192* How Should Scientific Research Be Administered? Seven prominent research administrators discuss the selection of research administrators, the setting of research goals, the planning and organization of research, and the control of research. ***Cecil E. Angell, et al.*** *Business Horizons*, v. 1, no. 3, Summer 1958, p. 52-61.

1193* Industry's Inexcusable Accident Toll. During an average workday, one worker is killed or crippled every 3 minutes, and one is injured every 11 seconds. The accident problem continues to be appalling even though the need for its control commands generally recognized importance and consistently positive response. ***Clayton F. Van Pelt.*** *Business Horizons*, v. 2, no. 1, Spring 1959, p. 93-98.

1194* You Too Can Create, If . . . A look at the instructive approach to innovation. *Electronic Design*, v. 7, no. 17, Aug. 19, 1959, p. 58-60.

1195* Protection Against . . . Trade Secret Disclosures. A growing trend for courts to recognize a property right in ideas; discloses the legal background of an interesting recent case which may further the trend. ***Albert Woodruff Gray.*** *Electronic Design*, v. 7, no. 17, Aug. 19, 1959, p. 62-63.

1196 What Role for Basic Research? How modern basic research works for industry. *Electronics*, v. 32, no. 33, Aug. 14, 1959, p. 38-39.

1197* Three Rules to Help You Stop Thieves in Your Plant. Everything from paper clips to diamonds (including money) is fair game for the plant thief. Here are six case histories. ***John A. King.*** *Factory*, v. 117, Aug. 1959, p. 168 + 8 pp.

1198* Why Exhibit? Seriously questions the value of trade shows as an industrial sales tool. ***G. E. Seavoy.*** *Industrial Marketing*, v. 44, Aug. 1959, p. 49-51.

1199* Blue-Sky Profits. Proves the dollars-and-cents value of basic research to industry. ***Theodore Berland.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 44-51.

1200* Research Business vs. Research Institutes. Two opposite points of view are given by the author, on profit and non-profit research organizations. ***Roger W. Truesdail.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 52-61.

1201* The Martin Co.'s Wellspring of Ideas. Discusses the Research Institute for Advanced Studies (RIAS), an organization for basic research established in 1955 by the Martin Co. ***Welcome W. Bender.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 62-67.

1202* Our Non-Scientific Government. Scientists actually played a relatively more important role in the early affairs of our government when we were a weak agricultural nation than they do now. Suggests ways to remedy situation. ***Joseph W. Still.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 68-74.

1203* Is There Really a Shortage of Engineers? Everyone talks about the "shortage" of engineers, yet during the past year thousands of engineers walked the streets in search of work or were used as technicians. ***Earl C. Kubicek.*** *Industrial Research*, v. 1, no. 3, Summer 1959, p. 76-80.

1204* Some Mechanical Equipment in the Heavy Industries of South Wales. Discusses coal mining, electricity generation, gas supply, oil refining, ironworks, Al fabricating, Ni production problems. ***W. F. Cartwright and I. S. Scott-Maxwell.*** *Institution of Mechanical Engineers, Proceedings*, v. 172, no. 32, 1958, p. 901-914 + 8 plates.

1205* One Determinant of Judged Semantic and Associative Connection Between Words. Investigates the role of word-word relations, apart from word content, in three kinds of judgments of verbal connection: similarity of meaning, relatedness of meaning, and associative strength. ***John H. Flavell and Eleanor R. Flavell.*** *Journal of Experimental Psychology*, v. 58, no. 2, Aug. 1959, p. 159-165.

1206* The Research Laboratory. Discusses the areas in which modern research laboratories have been most successful, and also those areas in which further effort might be rewarding. ***N. Perkowski.*** *Journal of Industrial Engineering*, v. 10, no. 4, July-Aug. 1959, p. 255-260.

1207* On Stochastic Linear Systems. Concerns the mathematical treatment of systems governed by n^{th} order linear differential equations having random coefficients. The equations studied are differential equations containing small randomly varying parameters, equations containing slowly varying random coefficients, and equations containing only one random coefficient. ***J. Clifton Samuels and A. Cemal Eringen.*** *Journal of Mathematics and Physics*, v. 38, no. 2, July 1959, p. 83-103.

1208* A Graph Theoretic Method for the Complete Reduction of a Matrix With a View Toward Finding Its Eigenvalues. *Frank Harary.* *Journal of Mathematics and Physics*, v. 38, no. 2, July 1959, p. 104-111.

1209* On the Line-Group of Two-Terminal Series-Parallel Networks. *Frank Harary.* *Journal of Mathematics and Physics*, v. 38, no. 2, July 1959, p. 112-118.

1210* On the Quadratic Detector. I. Shows the equivalence of the quadratic detector problem for a certain class of stochastic processes to the problem of taking the Wiener average of a related functional. ***Frank Kozin.*** *Journal of Mathematics and Physics*, v. 38, no. 2, July 1959, p. 119-125.

1211* Intermittent Rotors. Rotors which make multiple contact with the fixed elements (lines, circles, points, or other elements) but not always with all the elements, are discussed. ***Michael Goldberg.*** *Journal of Mathematics and Physics*, v. 38, no. 2, July 1959, p. 135-140.

1212 Two New Research Laboratories. Republic Steel shows direct stripmaking technique; Harbison-Walker unveils new Al refractory. *Journal of Metals*, v. 11, Aug. 1959, p. 508-509.

1213 Patent Fundamentals. A basic guide to what the company and engineer should know about handling ideas, inventions, and patents. ***D. W. Karger.*** *Machine Design*, v. 31, Aug. 20, 1959, p. 134-148.

1214* Selection and Use of Roller and Wheel Conveyors. II. *Material Handling Engineering*, v. 14, no. 11, Aug. 1959, p. 56 + 4 pages.

1215* The Post Office Does Something About Its Handling. A conveyorized system called Mail-Flo. It is the prototype of many installations scheduled throughout the country, and symbolizes progress that the Post Office is making. *Material Handling Engineering*, v. 14, no. 11, Aug. 1959, p. 60 + 3 pages.

1216* A Study of a Numerical Solution to a Two-Dimensional Hydrodynamical Problem. Reports the results obtained on Maniac I when that machine was used to solve, numerically, a set of difference equations approximating the equations of two-dimensional motion of an incompressible fluid in Eulerian coordinates. ***A. Blair, N. Metropolis, J. Von Neumann, A. H. Taub, and M. Tsingou.*** *Mathematical Tables and Other Aids to Computation*, v. 13, no. 67, July 1959, p. 145-184.

1217* A Method of Computing Eigenvectors and Eigenvalues on an Analog Computer. The described technique yields both eigenvectors and eigenvalues of a real symmetric or complex Hermitian matrix. ***Lucien Neustadt.*** *Mathematical Tables and Other Aids to Computation*, v. 13, no. 67, July 1959, p. 194-201.

1218* Man's Conflict With Technical Progress. Can technical progress be regarded entirely as a blessing to mankind? Or does it contain within itself properties endangering the foundations of our society? In this Towne Lecture of 1958, Dr. Boveri calls for action, that succeeding generations may have the mental and moral disciplines to guard freedom, the freedom that made technical progress possible. ***Walter E. Boveri.*** *Mechanical Engineering*, v. 81, July 1959, p. 34-37.

1219* Materials Handling in Industry. The efficiency of handling is measured by the ratio of processing time to the sum of the times of processing and handling. The objective of good materials handling is to reduce the denominator in this expression: this leads to lower production cost, less handling time, increased production capacity, and improved safety. ***W. A. Woeber.*** *Mechanical World and Engineering Record*, v. 139, Aug. 1959, p. 342-346.

1220* Should We Go to the Metric System? This problem has once again been brought up for discussion by Admiral Lewis L. Strauss's proposal for its adoption. *Metal Progress*, v. 76, no. 2, Aug. 1959, p. 65-66.

1221* What Incentives Are Not . . . Concerns incentive-type contracts now being used by the Department of Defense and the various services. *Missile Design & Development*, v. 5, Aug. 1959, p. 6.

1222 Urban Renewal in Three Large Cities. The programs of Pittsburgh, Cleveland, and Cincinnati are described. *Monthly Business Review*, Aug. 1959, p. 3-10.

1223* On the Limit of Solutions of Differential-Difference Equations as the Retardation Approaches Zero. ***Richard Bellman and Kenneth L. Cooke.*** *National Academy of Sciences, Proceedings*, v. 45, July 1959, p. 1026-1028.

1224* On the Breadth and Co-Dimension of a Topological Lattice. ***Lee W. Anderson.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 327-333.

1225* Extensions of a Theorem of Loewner on Integral Operators. The purpose of this paper is to extend the result of Loewner in *A Topological Characterization of a Class of Integral Operators.* ***Donald C. Benson.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 365-377.

1226* A Duality Theorem for an Arbitrary Operator. Studies the spectral theory of an operator (or bounded linear transformation) on a Banach space *B*. Although it would be possible to modify the results to apply to operators on non-reflexive spaces, for simplicity only reflexive spaces are considered. ***Errett Bishop.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 379-397.

1227* The Asymptotic Distribution of the Eigenvalues for a Class of Markov Operators. An extension of the paper "Markov Operators and Their Associated Semi-groups" by R. K. Getoor. ***R. M. Blumenthal and R. K. Getoor.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 399-408.

1228* Almost Locally Pure Abelian Groups. Introduces a preliminary investigation of almost locally pure Abelian groups. For primary groups the concept of almost locally pure Abelian group coincides with that of no elements of infinite height. ***D. L. Boyer and E. A. Walker.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 409-413.

1229* Involutions on Banach Algebras. Presents a systematic study of involutions (conjugate linear antiautomorphisms of period two) on a complex Banach algebra *B*. Particular attention is given to two types of involutions which make frequent appearance in the literature on Banach algebras-symmetric involutions (xx^* has non-negative spectrum for all x) and proper involutions ($xx^* = 0$ implies $x = 0$) where $x \rightarrow x^*$ is the involution. ***Paul Civin and Bertram Yood.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 415-436.

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1231* Connectivity of Topological Lattices. Shows that compact connected topological lattices have strong acyclicity properties, both globally and locally. This yields a proof of a conjecture of A. D. Wallace in the finite dimensional case. ***Eldon Dyer and Allen Shields.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 443-448.

1232* Markov Operators and Their Associated Semi-Groups. Considers a temporally homogeneous Markov process, $x(t)$, in a locally compact, separable, metric space and certain other processes derived from it. ***R. K. Getoor.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 449-472.

1233* A Bound for the Orders of the Components of a System of Algebraic Difference Equations. The object of this paper is to obtain a bound for the orders of the components of a system of algebraic difference equations, each component of which is of dimension zero. In the analytic case, this roughly amounts to determining the maximum number of arbitrary functions of period unity which each corresponding manifold can possess. ***Bernard Greenspan.*** *Pacific Journal of Mathematics*, v. 9, no. 2, Summer 1959, p. 473-486.

1234 Get Better Curves From Your Data. Use of the method of least squares to get better correlations from data and their quality for making predictions. ***Murray Greyson and Joanne Cheasley.*** *Petroleum Refiner*, v. 38, Aug. 1959, p. 135-142.

1235 Use These Tricks to Speed Up Answers. Here is a simple problem involving trial-and-error calculations. See how general relations help make better first guesses for multicomponent calculations of a hydrodesulfurizer and absorber. ***Alfred Doll-Steinberg.*** *Petroleum Refiner*, v. 38, Aug. 1959, p. 143-145.

1236 How to Remember. I. Sharpen Your Thinking Habits. It stands to reason that you can't forget something if you never really learned it in the first place. Therefore, practice these techniques of learning in order to develop your power of retention—and remembering. ***John D. Quinton.*** *Petroleum Refiner*, v. 38, Aug. 1959, p. 175 + 5 pages.

1237 How to Present a Construction Estimate. Outlines basic facts that should be included if estimate is to be approved. ***William I. McKay.*** *Petroleum Refiner*, v. 38, Aug. 1959, p. 185-188.

1238 How the East German Engineer Lives and Works. Early this year, *Product Engineering*'s editor in Bonn was given special permission to visit East Germany and Czechoslovakia. Here are his observations of engineering life in these countries. ***Jim Morrison.*** *Product Engineering*, v. 30, no. 32, Aug. 10, 1959, p. 38-40.

1239 Creativity . . . The Facts Behind the Fad. Summarizes those facts brought to light at a recent 3-day Harvard Conference. ***E. J. Tangerman.*** *Product Engineering*, v. 30, no. 34, Aug. 24, 1959, p. 20-23.

1240 Cooperative Research Advances Engineering Knowledge. Competing companies work in harmony to advance state of the art. This method permits R & D and engineering to concentrate on other projects, giving a two-prong attack on future markets. *Product Engineering*, v. 30, no. 34, Aug. 24, 1959, p. 27 + 2 pages.

1241 The Use of Monte Carlo Models, Man-Machine Simulation, and Analytical Methods for Studying Large Human Organizations. Paper describes briefly method used in conducting study of a large human organization in which many features of the organization could be developed. ***M. A. Geisler.*** *Rand Corporation, Report* P-1634, Mar. 11, 1959, 14 pp. (T13 R15r Contin.)

1242* The Pleasures and Pains of Small-Business Research. The pros and cons of research investment by small businesses are discussed. ***Lyle M. Spencer.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 5-12.

1243* Research and Development Assistance for Small Business Outside of the Company. A practical guide for the wise use of research facilities available to small business. ***Charles N. Kimball.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 13-21.

1244* Organization, Assignments, and Expectations. Describes operation and responsibilities of a research laboratory. Also, the necessary qualities of a research director are outlined. ***C. L. Fleming, Jr.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 23-31.

1245* Representative Costs of Doing Research and Development. If the present exponential growth of research continues during the next twenty years, research spending will reach an annual rate of $18 billion by 1970 and $25 billion by 1980. ***Gerard C. Gambs.*** *Research Management*, v. 2, no. 1, Spring 1959, p. 33-43.

1246 Are You Prepared in Case of Fire? Discusses fire safety precautions in the plant. ***John M. Neeson.*** *American Paint Journal*, v. 44, Oct. 12, 1959, p. 35 + 2 pages.

1247* The Status of Foreign Trademarks. There is a growing increase in the importance of imported trademark articles. Discusses the manner of protection afforded to foreign trademarks. ***Delavan Smith.*** *American Perfumer and Aromatics*, v. 74, Sept. 1959, p. 34 + 3 pages.

1248* Optimal Confidence Intervals for the Variance of a Normal Distribution. Technique yields either the confidence interval of minimum length or the "shortest" unbiased interval for the variance of a normal distribution. ***R. F. Tate and G. W. Klett.*** *American Statistical Association, Journal*, v. 54, no. 287, Sept. 1959, p. 674-682.

1249* The Businessman's Stake in Urban Renewal. In a business sense, cities are not only markets but are working capital—and the rebuilding they need is replenishment. *Architectural Forum*, v. 111, no. 5, Nov. 1959, p. 146-147.

1250 Training Ground for Technicians. Public schools are helping to meet the shortage of skilled workers by adding technical education programs. *Business Week*, no. 1575, Nov. 7, 1959, p. 76 + 4 pages.

1251 Looking Outside for Research Perspective. Cyanamid's Bourland picked five-man consultants team to advise on research strategy, administration. *Chemical Week*, v. 85, no. 10, Sept. 5, 1959, p. 91-93.

1252* Engineering Research in Arctic Alaska. Most of the Arctic research under way in Alaska is oriented toward the acquisition of information leading to a rational solution of the few engineering problems peculiar to Arctic climates. If the projects are successful, the many forms of ice can be efficiently used as engineering materials to provide a design advantage rather than a handicap. ***Harold R. Peyton.*** *Civil Engineering*, v. 29, Sept. 1959, p. 52-53.

1253* The Proper Study of Mankind Is Man. Discusses the need for a better understanding of the goals of science and the nature of man. ***James Gray.*** *Discovery*, v. 20, Sept. 1959, p. 385-387.

1254* Human Relations and Accident Prevention. A correlation exists between human relationships in the working environment and the accident frequency rate. ***W. E. Montgomery.*** *Edison Electric Institute Bulletin*, v. 27, Sept. 1959, p. 303-306.

1255 Establishment of a Commission on a Department of Science and Technology. Report on and recommendation for passage of a bill to establish a commission which would work for the future establishment of an executive department of science and technology. 14 pp. 1959. U. S. Government Printing Office, Washington. (Q180.U5 Un3.273e)

1256 Experimental Designs in Industry. Reviews the classical designs and gives a sound account of factorial experimental designs in both complete and incomplete blocks; supplies actual illustrations of the use of incomplete blocks, fractional factorial and response surface designs in industrial research. ***Victor Chew, editor.*** 268 pp. 1958. John Wiley & Sons, Inc., New York. (T175 N81)

1257 The Game Theory in U. S. Strategy. Explains the theory that it is in the interest of the U.S. for Russia to have an invulnerable retaliatory force. ***Oskar Morgenstern.*** *Fortune*, v. 60, no. 3, Sept. 1959, p. 126 + 6 pages.

1258 Magnetic Caltech. This small institution could be taken as a model by schools aiming to encourage scientific creativity. ***George A. W. Boehm.*** *Fortune*, v. 60, no. 3, Sept. 1959, p. 148 + 7 pages.

1259 Year 'Round Air Conditioning Brings Existing Office Building Up to Date. The Hurt Bldg., Atlanta's largest office structure, was brought up to today's office standards with the recent installation of year 'round air conditioning. ***Ronald L. Moore.*** *Heating, Piping & Air Conditioning*, v. 31, Sept. 1959, p. 127-130.

1260 The Consulting Engineer's Responsibilities and Fees: Two Points of View. A consulting engineer and an engineering contractor speak their minds. *Heating, Piping & Air Conditioning*, v. 31, Nov. 1959, p. 112-117.

1261 Highway Research Organizations. Highway Research Board, Special Report 15. Description of existing organizational patterns and scope of activities. ***Earl Campbell.*** 44 pp. 1953. National Academy of Sciences—National Research Council, Washington, D. C. (TE153 N21h)

1262 International Handbook of Universities. Provides classified information concerning higher education in some 70 countries; 26 in Europe, 19 in Latin America, 13 in Asia, 5 in the Middle East, and 7 in Africa. ***H. M. R. Keyes, editor.*** 338 pp. 1959. R. & R. Clark, Edinburgh. (T13 Un4i)

1263 Inventions, Patents, and Their Management. This book teaches the language of the business of inventing as used by attorneys, engineers and executives working extensively in this field. By giving a logical grasp of the legal, technical, and commercial terms having to do with the subject, it enables the inventor to understand the people he must work with and to make himself understood by them. ***Alf K. Berle and L. Sprague de Camp.*** 602 pp. 1959. D. Van Nostrand Company, Inc. New York. (T212 B45ip)

1264 Jane's Fighting Ships. 446 pp. 1958-1959. McGraw-Hill, New York. (VA40 J25)

1265* Short-Term Retention of Individual Verbal Items. It was concluded that short-term retention is an important, though neglected, aspect of the acquisition process. ***Lloyd R. Peterson and Margaret Jean Peterson.*** *Journal of Experimental Psychology*, v. 58, no. 3, Sept. 1959, p. 193-198.

1266* The Power of Thought—New Horizons. The military professional must continually seek to shed the cloak of convention and complacency in a never-ending search for realistic, practical answers for tomorrow's problems today. ***Lionel C. McGarr.*** *Military Review*, v. 39, no. 6, Sept. 1959, p. 3-19.

1267 Patterns of Discovery. An Inquiry Into the Conceptual Foundations of Science. Shows that there is a logical pattern in finding theories as much as in using established theories to make deductions and predictions and sets out the features of this pattern with the help of striking examples in the history of science. ***N. R. Hanson.*** 241 pp. 1958. Cambridge University Press, London. (Q175 H19p)

1268* Water—An Outstanding Problem. Discusses problems of water supply, its use in power plants, use of mineral water and treatment of polluted water. (*In Polish.*) Woda—wielki problem. ***E. Zaczyński.*** *Przeglad Techniczny*, 1959, no. 27, July, p. 6-8.

1269 Pure and Applied Physics. v. IV. Irreducible Tensorial Sets. Presents mathematical methods which originate from the theory of coupling and recoupling of angular momenta in atomic physics and constitutes an extension of vector and tensor algebra. A unified treatment with a compact system of notations is attempted. ***U. Fano and G. Racah.*** 171 pp. 1959. Academic Press, New York. (QA433 F21i)

1270 Pure and Applied Physics. v. V. Group Theory and Its Application to the Quantum Mechanics of Atomic Spectra. The application of group theoretical methods to problems of quantum mechanics with specific reference to atomic spectra is described. The actual solution of quantum mechanical equations is, in general, so difficult that one obtains by direct calculations only crude approximations to the real solutions. ***Eugene P. Wigner.*** (Translated from the German by J. J. Griffin.) 372 pp. 1959. Academic Press, New York. (QA171 W63g)

1271 Pure and Applied Physics. v. VI. Mathematics in Physics and Engineering. Describes analytical and numerical

desk-machine) methods that arise most frequently in present day pure and applied science. Gives methods for problem solution rather than derivation. ***J. Irving and N. Mullineux.*** 883 pp. 1959. Academic Press, New York. (QA37 Ir8m)

1272* A Primer on Inflation. This is a special report on inflation. The twists and turns of money policy have made inflation vividly real to millions of Americans. It has clipped the value of a dollar in half in just 20 years. When government uses credit to build more highways, airports, and waterways, it is only making the situation worse. Here is a railroad story, reported in understandable terms for the layman—the customers, the opinion leaders, the voters. *Railway Age*, v. 147, Oct. 5, 1959, p. 16-21.

1273* Space Knowledge and Its Impact on Future Research. Reviews current activities. ***Hugh L. Dryden.*** *Research Management*, v. 2, no. 2, Summer 1959, p. 67-80.

1274* The Art of Listening. Shows that, despite the fact that 45% of our communication time is spent listening, we listen at a sixth grade level. ***Ralph G. Nickols.*** *Research Management*, v. 2, no. 2, Summer 1959, p. 97-117.

1275* A System for Reducing Fire Hazard in Rubber Dust Collecting. Equipment design has provided the answer to a long-standing problem associated with rubber grinding. ***Edward M. Dickinson.*** *Rubber Age*, v. 85, no. 5, Aug. 1959, p. 795-797.

1276 Service and Repair of the Hamilton Electric Watch. Disassembly, assembly and cleaning procedure; function and adjustment; trouble shooting—procedure and equipment. 106 pp. 1959. Hamilton Watch Co., Lancaster, Penn. (TS547 H18s)

1277* Parameter Estimation for Waveforms in Additive Gaussian Noise. The approach to be followed here is based on results in statistical estimation theory concerning the greatest lower bound for the variance of estimates of statistical parameters. ***P. Swerling.*** *Society for Industrial and Applied Mathematics, Journal*, v. 7, no. 2, June 1959, p. 152-166.

1278* On the Bias Errors of Least Squares Digital Filters. This paper contains a convenient method of obtaining the bias errors or dynamic lag errors resulting from operating on an input function with a least squares digital filter. ***Marvin Blum and Hirsch Gottschalk.*** *Society for Industrial and Applied Mathematics, Journal*, v. 7, no. 2, June 1959, p. 205-214.

1279 The Monorail Potential. The modern medium of high-speed mass transportation, exemplified by a modern monorail system, gives promise of furnishing the solution to the transit and traffic problems tormenting cities today. ***S. H. Bingham.*** *Society of Automotive Engineers, Preprint* 15R, 1959, 6 pp.

1280 Physical Measurement—A Challenge to Science and Engineering. The frontiers of measurement are the frontiers of science and technology. In other words, they are the frontiers of our knowledge of the physical world and of our ability to make constructive use of that knowledge. ***Allen V. Astin.*** *Society of Automotive Engineers, Preprint* 21R, 1959, 7 pp.

1281 Increasing Research, Development. Number seven in Steel's 1959 Program for Management series. *Steel*, v. 145, Aug. 17, 1959, p. 87-94.

1282 Corporations Step Up Aid to Higher Education. Here Are Guides to Giving. How leading industries determine amounts to be allotted to college scholarships. *Steel*, v. 145, Oct. 5, 1959, p. 60-61.

1283 Symposium on Basic Research. Papers presented at the Caspary Auditorium of the Rockefeller Institute, New York City, May 14-16, 1959, on advantages, requirements, and facilities for basic research in universities and private and government laboratories. ***Duel Wolfle, editor.*** 308 pp. 1959. American Association for the Advancement of Science, Washington, D. C. (Q180.U5 Sy68p)

1284 Technology in American Water Development. This first exhaustive study of America's water problem examines virtually every aspect of water—its sources, location, conservation, uses, management, and economics. ***Edward A. Ackerman and George O. G. Löf.*** 709 pp. 1959. Johns Hopkins Press, Baltimore. (TD345 Ac57t)

1285 Technical Research Activities of Cooperative Associations. Explains patent arrangements, most applicable type of research problems, and describes current association research activities. 59 pp. 1959. U. S. Printing Office, Washington. (T176 Un3.274t)

1286* The Speed Factor in Highway Accidents. Where sufficient data are available for statistical stability, they show a high involvement rate at the lower speeds, a decrease in the rate at moderately high speeds, and an upturn in the rate at speeds above that point. ***C. W. Prisk.*** *Traffic Engineering*, v. 29, no. 11, Aug. 1959, p. 16 + 2 pages.

1287 Concerning the $v/N \to 1/3$ Resonance. III. Use of the Moser Method to Estimate the Rotation Number, as a Function of Amplitude, for the Equation $\frac{d^2v}{dt^2} + \left(\frac{2\pi}{N}\right)^2 v + \frac{1}{2}(\sin 2t)\, v^2 = 0$. The Moser method of analysis, as applied through terms of order $(v/N - 1/3)^3$ in an earlier report, is here employed to determine the variation of rotation number (or "tune") with amplitude for solutions of the nonlinear differential equation given in the title. ***L. Jackson Laslett.*** *U. S. Atomic Energy Commission, MURA*-461, May 28, 1959, 17 pp. (UF767 Un3.1mu Contin.)

1288 A Table of Three Exponential Integrals. ***D. K. Trubey.*** *U. S. Atomic Energy Commission, ORNL*-2750, July 2, 1959, 61 pp. (UF767 U3o Contin.)

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